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EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

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Contents of this Issue

The Advantages of Consolidation

Whatever may be the opinion of political economists as to the desirability to the public of the suppression of trusts, there can hardly be any question, we believe, as to the benefits to be derived from the consolidations of natural monopolies. The street railways of a city fall under the category of natural monopolies, and the tendency during the last ten years toward the unification of all the systems in one city has been very marked. In fact, it is difficult to cite more than a very few cities where the entire system is not in the hands of one company, and in these exceptions the separate companies are few in number and each serves exclusively a very large territory, so that they are not real exceptions to the rule. In other words, competition in local transportation in the cities of this country is practically past, and the public is better served as a whole, has better cars and can ride longer distances for a single fare than ever before in the history of the country.

One of the large cities of the United States in which the plan of many competing companies was maintained for a longer period than in almost any other, but in which the systems have finally become consolidated during the past few months, is New Orleans, and steps are now being taken which were impossible before to give improved transit facilities in that city. Like most American cities, there was one principal business street, Canal Street, and each competing company in former days considered it necessary to run cars and to have its principal terminal on this street. Fortunately, the street was a wide one, and as a result there were five separate tracks extending practically its entire length, with unavoidable congestion of street traffic. The consolidated company now proposes to remove most of these tracks by changing the different routes so that most or all of the lines will cross Canal Street, but will give transfers to and from a single line of cars, running practically its entire length, by which the traffic on that street will be cared for. The details of this plan, as well as a striking view of the present condition of the thoroughfare, are published elsewhere in this issue, and the proposition is now under consideration by the city authorities.

Suburban Traffic

The question of caring for the suburban traffic on steam lines has forced itself upon the management of many roads, and others are being confronted with the same problem every day. Few of them seem to be ready to meet it in a practical manner, and not one, to our knowledge, has provided in advance against the invasion of the trolley in the suburban field. This lack of foresight on the part of the steam railway managers has occasioned much comment and some criticism, but thus far there has been no reasonable explanation on the part of the steam roads. Apparently the railroads are "quite well satisfied with the situation," as stated by the "Railway Review," which goes on to say that except in rare instances suburban passenger traffic does not pay, and most roads are only too glad to find an excuse for abandoning it. Such a suburban service as that of the Illinois Central, in Chicago, undoubtedly is profitable, our contemporary admits, but nowhere near to the extent that is popularly supposed. But the Illinois Central is in an exceptional position, it declares, as this road possesses exceptional facilities, and its suburban service is as separate and distinct from its regular traffic as if it belonged to an entirely separate company. It has separate tracks, cars, engines, stations and all other paraphernalia necessary for conducting the business, an advantage which is not commonly possessed, but this is just the point which we have contended all along, namely, that the big steam railway systems are in position to furnish this service and should provide the electrical equipment and organization. The "Review" declares that the legitimate business of railroading does not seem to be within the realm of a 5 or 10-cent suburban fare, and to allow that kind of traffic to interfere in any way with the larger and more important business of the road is beginning to be regarded as a mistake. This is a

question that the steam road managers will have to find for themselves, but it seems to us that such a statement amounts simply to an admission that they are not able to handle this business. Many of the big roads have spent considerable money in developing this traffic, but they cannot hope to retain it unless they supply better accommodations, and this can only be done successfully by adopting electrical equipment.

Air Blast Railway Motors

Transformers are almost doubled in permissible output by the simple application of an air blast to carry away the heat that would otherwise be imprisoned in the casing. Why cannot the principle be applied with advantage to railway motors, especially those intended for heavy traction? The large increase in motor capacity obtained by leaving the cases opened, a device permissible in elevated work, is well known. Why not carry the matter a little farther and force the air through with a blower? This device would at once change the load limit from a temperature limit to one of commutation, efficiency and similar considerations, and would possibly have the effect of making the present hour rating a continuous one, which in interurban work is a consummation devoutly to be wished. The increased life of the windings and the absolutely tight casing also offer advantages which in themselves quite counteract the disadvantage of maintaining the little motor and blower which would be necessary. A further consideration, with reference to the device, is rather radical, but nevertheless attractive. Taking a 200-hp equipment, a fair interurban figure, working at a net efficiency of 60 per cent, counting the use of resistances in control, it is safe to say that of the 40 per cent losses one-half could be absorbed by the air of the blower system. Twenty per cent of 200 hp is 29.84 kws, or about the energy absorbed by five ordinary sets of car heaters. It looks as if the heaters would pay for the motor, blower and piping. To keep the motors and resistance cool, the passengers warm, and save the entire heater current by the process, sounds too good to be true. Of course motors do not always run at full load, and these figures require shaving, but they can withstand the process.

As to the energy for the blower motor every particle of it will appear as heat in the car atmosphere. The energy consumed in arc headlight resistance is not only ample but available for such a motor. An electric car is rather a wasteful combination after all.

The Excursion Business

In some respects the moderate summer which the country has enjoyed this season has been detrimental to the excursion business of electric railway companies, as the need of outings has not been felt to the usual extent by the general public. At the same time the cool weather has had an opposite effect in keeping many people in the cities, as the doleful tales of lack of patronage from the managers of seaside hotels and other summer resorts indicate. The people who have not left the city for the country have contented themselves with trips nearer home, and it is the general verdict that the excursion business of the average city railway during the present season has been up to that of past years, if not somewhat greater. This is a branch of the business which can be developed by systematic effort, as has been proven on many occasions. The maintenance of street railway parks and pleasure resorts of various kinds is entirely in this line in that they tend to create traffic. We believe, however, that many of the railways of the country have reached a size now when they could afford to maintain a regular passenger department, and that such a course would prove of great benefit. The general passenger agent of the average steam railroad devotes himself entirely to the development of traffic, to preparing the literature published by the company and seeing that the road is properly advertised. A field has been found here which does not conflict in any respect with the duties of the general manager or superintendent. We do not mean to say that the general passenger agent of an electric railway company need have so large a staff as that of the same officer on many of the steam railroads, or that the department need be anywhere near so expensive. But the possibilities in the way of educating people to ride in one way and another are so extensive that this work should not, on a large system, be thrown exclusively on the shoulders of the general manager, although the general passenger agent would necessarily have to consult with him and report to him on any plans which he may develop. This method of establishing a special branch of the operating division to care for this work, under the title of a "general passenger department," or "outing department," as it is called in Cleveland, has been followed on a few of our large systems with very satisfactory results, and it is certainly worth the consideration of the managers of any system on which the excursion traffic is a large feature of the business.

Omnibuses vs. Trolley Cars

A striking example of the difference in the eyes of the law, certainly English law, between an omnibus and a street car was given during "coronation week," last month, by the omnibus companies in London. A street railway company is supposed, through the privilege granted it of laying rails in the streets, to have entered into a contract with the city authorities by which it guarantees to carry passengers for a certain rate of fare. Omnibus companies, however, are on the same footing as the owners of private vehicles, can carry passengers or not as they choose, and can charge any rate of fare which pleases them. In fact, the only municipal regulation governing the rates of fare of the omnibus in London is that these rates should be conspicuously posted in some part of the omnibus, and that the fares charged should correspond to those so posted. There is no law to prevent the posting of a different set of rates every day, or even oftener, if the company desires. The result of this was that the omnibus companies took advantage of the fact that London was crowded at the coronation time and that transportation facilities were at a premium, to double and treble their rates, and in some cases increase them in a still greater ratio. For instance, the rates between Ludgate Circus and Charing Cross, which are about a mile apart, was increased from 1 penny to 6 pence. The following are a few of the rates charged during that week (that ending June 28) by a number of the principal omnibus lines in the city:

Liverpool Street to Ludgate Circus	2d.
Chancery Lane to Charing Cross	3d.
Ludgate Circus to Charing Cross	6d.
Bank to Piccadilly Circus	8d.
Charing Cross to Piccadilly Circus	3d.
Charing Cross to Victoria	4d.
Bank to Victoria	8d.

On the line between Piccadilly Circus and Liverpool Street, a distance of not more than 3 miles, the fare outside was 8 pence and inside 6 pence, and there were no intermediate fares. Even the ha'penny 'buses over the bridges charged penny fares.

In this respect of increasing their rates the omnibus companies followed the practice of the cab companies, the hotels, the restaurants, and in fact of nearly all concerns outside of the steam railroad companies, who catered to public requirements in London. It seems somewhat of an anomaly that a company which supplies its own roadway, as a street railway company does, should be treated less generously than one which wears out the public highway and gives at the same time a slower and more noisy transportation service. Nevertheless, in the eyes of the English law the omnibuses are on the same footing as the owners of any other public conveyance, as a cab. We do not know what would be the exact difference in status in this country, nor is it very important, as omnibus lines could not do the business here accomplished by our street railway systems, but it is somewhat curious that our English cousins in giving such latitude to the old-fashioned vehicle, and while restricting the improved motive power so closely, have in this way perpetuated an institution which the city of London, with its long distances and vast commercial interests, has long ago outgrown.

Schedules for Trolley Lines

The necessity for observing the schedule is generally recognized by transportation companies in cities and between important business centers, but the trolley lines in many rural districts, and especially those serving pleasure resorts, are not run on any fixed plan. Most of the latter have schedules printed in their advertisements, and the unwary stranger who depends upon them for making connections is often grievously disappointed. This is a serious mistake, and soon brings the management into disrepute, for there is nothing which the average pleasure seeker resents so much as a disarrangement of his plans. It matters not that he may make the trip the next day or on any other of the ten or dozen days which he has at his disposal. He is sorely disappointed, and usually he communicates his feelings to everybody about the hotel in which he is stopping. Thus the trolley line gets a bad name. In the case of one line which recently came under our personal observation the employees did not know that they were expected to make the schedule; it had not been observed early in the season, as traffic was light, and it became customary to run cars only when enough passengers had been secured to make it profitable. As a result the patronage of the road did not increase as the season advanced, and soon the schedule was entirely lost sight of, excepting by disappointed patrons.

Special Conditions in Franchises

Builders of new railways and street railway companies that are extending existing properties are very often confronted, when applying for franchises, by some clause, or set of clauses, which the authorities of the municipality through which their lines are to run wish inserted in the franchises. In some cases these requests are, of course, exorbitant and cannot be granted with safety to the financial condition of the property, but in many other cases the clauses are comparatively unobjectionable, and many arguments are marshalled in their favor by the public authorities and local newspapers. Where the company interested is operating in a large city and practically all of its lines are included within the boundaries of that city, a certain amount of latitude in granting demands of this kind can be exercised without very much future inconvenience, but the case is entirely different with an interurban railway company or, in fact, any company which has a number of municipalities to deal with. We believe that in cases of this kind it is much better, not only for the railway company but for the public as well, that the company should not be tied down by one set of restrictions and clauses in one town and another set in another town, or ever a uniform set of conditions, where these conditions are not absolutely necessary for the protection of the community against the company. In deciding what conditions are necessary for its protection the city authorities should remember that all railway companies are created by the State, and that the State laws, as a rule, provide against all abuses possible on the part of these companies. These State statutes are the result of a long experience with corporate enterprise, and will, in general, be found equitable in their application, while those restrictions which are not provided for in the State laws are often inadvisable and have not been made the subject of legislation for this very reason. Before indicating the advantages to both railway company and the general public by the exclusion of "unnecessary" clauses in the franchise, we will cite an example bearing directly on the point under consideration.

A certain railway company applied for a franchise in a city in the eastern part of New York State, but found that the community, while anxious to secure the construction of the new railway, thought that the interests of the city would not be entirely safeguarded unless the company agreed, in its franchise, to three conditions, viz.: (1) That the road should be in operation within five years; (2) that the fares should not be more than certain amounts, and (3) that the expense of making the crossings above and below the grades of the existing highways (the road being on its own right of way without grade crossings) should be paid entirely by the railroad corporation.

It so happened that none of these provisions was individually objectionable to the owners of the road, that is, they expected to have the line in operation long before the time set; the fares proposed by the city were those which they had planned to charge, and the State law under which the road was chartered required the construction of the crossings by the railway company. Nevertheless, the company properly took the ground that it was not advisable to have these conditions in its franchise, because the latter clause was unnecessary, having already been provided for, and because the two former, while they would be complied with, might act as an impedient in raising capital and also in future operation.

As a result, the president of the company, by appointment, met the official representatives of the city and leading citizens at a general town meeting, and went over the subject carefully with them. Taking up the first point, that of the time in which the construction should be completed, he pointed out the fact that a section of the Railroad Law of the State of New York explicitly states that the construction of a road must be begun and 10 per cent of the amount of its capital expended within five years, and furthermore, that if the road is not in operation within ten years from the time of filing its certificate of incorporation, its corporate powers cease; also that another section of the Railroad Law provides that if, at the end of two years from the time the company receives its certificate from the Board of Railroad Commissioners authorizing the construction of the road, such construction is not commenced, the board may inquire into the reasons of such failure and may revoke such certificate if it shall appear to be in the public interest to do so.

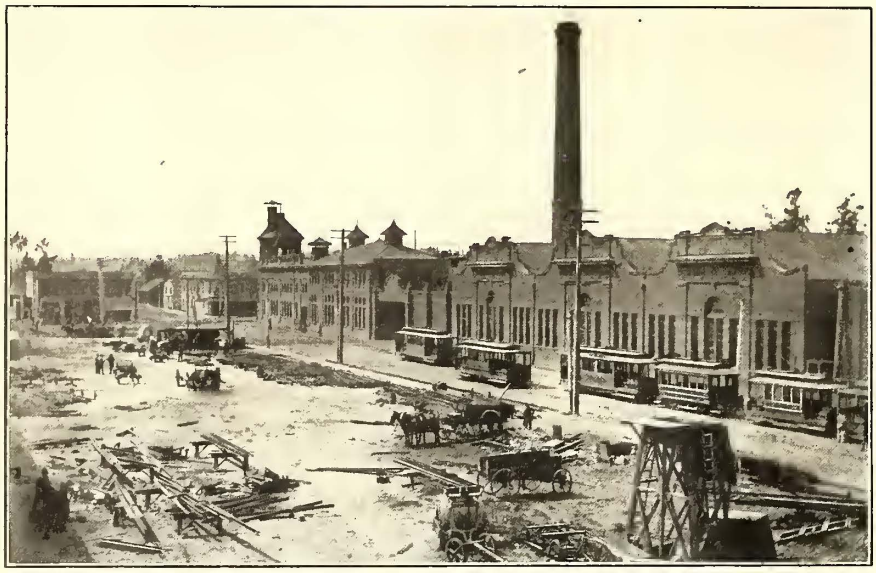
Taking up the second point, that of fares, he pointed out that the Railroad Law of the State, under which the company was incorporated, fully covers, also, the question of fares to be charged, by stating that the maximum rate may be 3 cents a mile, with a minimum fare of 5 cents, but that the Legislature can at any time reduce the mileage rate below that mentioned, provided that in doing so it shall not, without the consent of the company, reduce the net earnings to less than 10 per cent per annum on the capital actually expended. The fact was then pointed out that as these laws applied to all companies organized within the State, under the general railroad law, the interests of the community were fully protected. On the other hand, if any special contracts were made by the company, even if they coincided exactly with the State law as then in force, this fact alone might, and probably would, prejudice the company in the eyes of financiers, and might result either in the failure of the entire undertaking or else in the selection of a route outside of the boundaries of the particular city which insisted upon such a franchise. In other words, the company stood squarely up to the position of not being willing to waive from any of its statutory rights, and showed that in taking this stand it did so, not with the desire to impose on the city, but to assure the completion of the project which all those present admitted was as important to the city as to the company.

The sequel of this particular episode was that the town meeting voted unanimously in favor of giving the franchises without any restrictions whatever, and the incident was closed.

We realize that the temptation to any railway company, situated as this was, is often very great to quietly accept conditions of this kind, which appear harmless, and which, as a matter of fact, might never create any trouble. But those who have had much experience with railway operation realize that very often a limiting condition, such as the completion of a line by a certain time, which originally appeared entirely innocuous, will, through some unforeseen contingency, such as a financial crisis, cause a great deal of trouble. The consequence is that Wall Street looks upon all special conditions of this kind with a great deal of suspicion, and their inclusion in any franchise often jeopardizes the success of the entire property from a financial point of view.

The Pacific Electric Railway Equipment

The new power house, car houses and shops of the Pacific Electric Railway Company, of Los Angeles, Cal., which have recently been completed, comprise the largest electric railway equipment of this character on the Coast. The present company was incorporated on Nov. 14, 1901, but the work of construction on the new power plant and shops was well under way at that time. At present the company is operating 95 miles of single track in the cities of Los Angeles and Passadena, and the system extends to Mt. Lowe, Long Beach, Alhambra, San Gabriel, Monrovia, Santa Ana and other points. Ninety-eight motors and 16 trailers are now in service.



POWER STATION, SHOWING SITE OF NEW EXTENSION

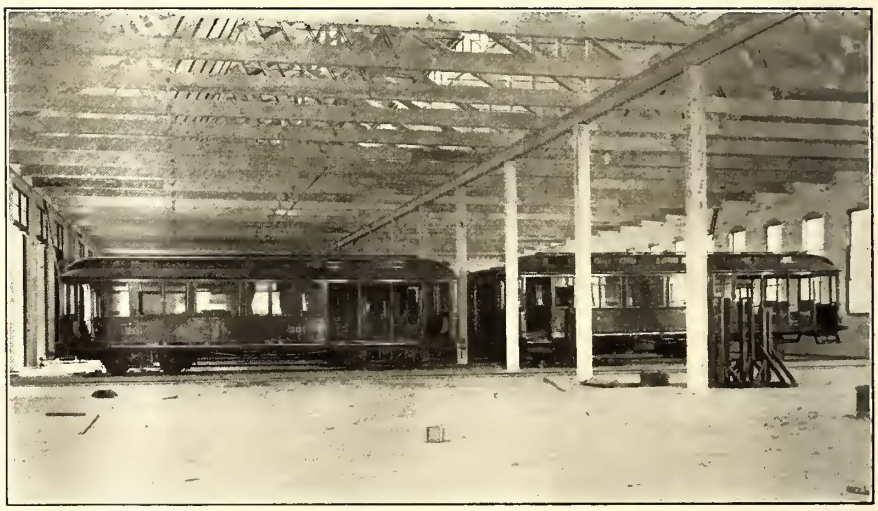
The present power station equipment comprises two 250-kw, two 200-kw and one 125-kw direct-current generators in the Passadena plant. The Los Angeles station, which is now being erected, will contain one 1050-kw direct-current generator, and two 1500-kw three-phase generators, three 600-kw and five 200-kw motor-generator sets. One 650-hp Ball & Wood cross-compound condensing engine, one 450-hp and one 250-hp machines of the same type are now employed, and an additional equipment is being installed, comprising one 2000-hp and two 2500-hp McIntosh & Seymour cross-compound condensing engines. Steam is furnished by four 250-hp Stirling boilers at the present time, and an addition of eight 400-hp Babcock & Wilcox boilers is being made.

Interest is centered at present in the big shops at Seventh and Alameda Streets and Central Avenue, in Los Angeles, which are now being equipped with machinery and machine tools. All machinery, except the steam hammers, is to be driven from electric motors. Work on this plant was begun on Oct. 28, and has so far progressed as to make it possible to turn out considerable work in several departments. It is proposed that all of the repair work of the Pacific Electric Railway Company and the Los Angeles Railway Company will be done in these shops, together with the building of cars and other mechanical work for the operation of the railway systems in Los Angeles and the suburbs.

There are five departments in the shops, and in addition the largest car house in the West is under construction and nearly completed and ready to receive the cars of the Pacific Electric Railway Company. The car house is at the west end of the large tract of land purchased by H. E. Huntington, fronting on Central Avenue and occupying almost the entire space of a block. The shops are primarily for repair work on cars of the two electric railway systems, and new cars will also be built.

The new shops are at present contained in six new buildings, namely, the machine and blacksmith shop, store and carpenter shop, paint shop, car repair shop and winding room, pattern shop and lumber store house and an oil house, to which will soon be added a brass and iron foundry.

In the construction of the buildings 3,000,000 ft. of lumber, 3,000,000 brick and 8000 barrels of Portland cement were used. The shops contain about 10,000 lineal feet of track for the reception of cars under construction or repair, and the car house contains about 5200 lineal feet of track for the storage and inspection of cars.

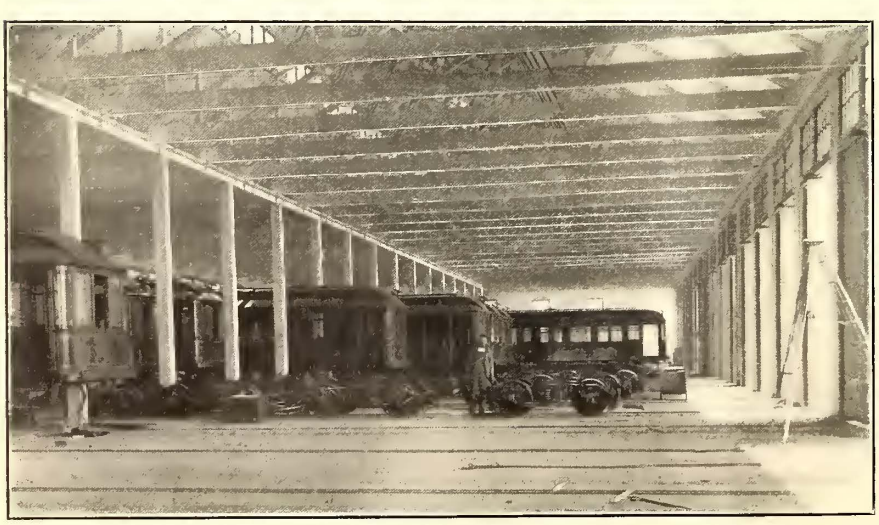


INTERIOR OF CARPENTER SHOP

The first floor area in the shops is over 3¾ acres, and in the car house over 1½ acres. There are 59 doors, 16 ft. high and 12 ft. wide, for the admission of cars to the shops. The pitch of all roofs is 30 degs. The roof trusses are combination wood and iron. All the buildings are of brick, with trussed roofs, no purlins or jack rafters being used. The roof planks, which are 2 ins. x 12 ins. tongue and groove Oregon pine, are spiked directly to the trusses. The brick walls extend directly up to this planking, and hence there are no pockets or draft runs for the spread of fire.

The inside of all the shops and car house is coated with white magnite, thereby diffusing light, and also intended to make spread of fire more difficult.

The building containing the machine and blacksmith shop is 276 ft. long, 100 ft. wide, and 22 ft. high in the clear. Of this a space 200 ft. in length is occupied by the machine shop and 76 ft. by the blacksmith shop. Three tracks, fitted for either broad or narrow gage cars, extend across the machine shop near one end. They have cement-lined pits, 4 ft. 6 ins. deep beneath them, to facilitate work on car trucks. The machine shop has a 10-



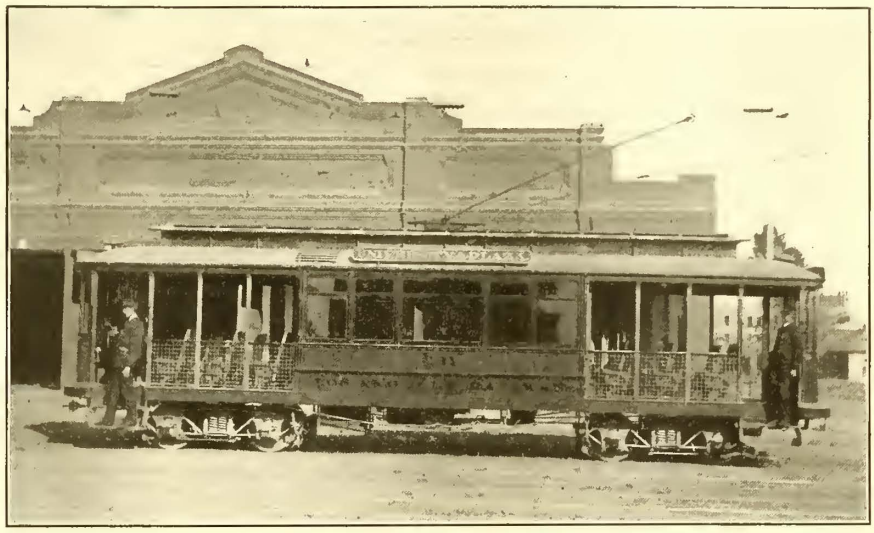
INTERIOR OF PAINT SHOP

ton traveling crane spanning its 35-ft. central bay, and traveling the length of the shop. This shop is newly fitted up with modern machinery for the making and repairing of cars. The blacksmith shop has swinging cranes, and besides the usual forges and fires has a double-frame 3000-lb. steam hammer in its list.

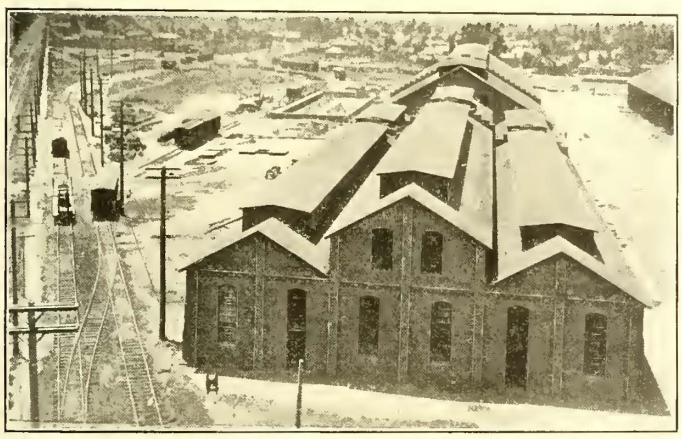
The building containing the store and the carpenter shop is 380 ft. long, 100 ft. wide, and 22 ft. high in the clear. Through the store, which occupies a space 100 ft. sq., there is provided a broad and narrow gage track for the receipt or shipment of supplies, and this department is fully fitted up with special places for the numerous articles to be found therein. The carpenter shop has ten tracks, for either broad or narrow gage cars, under three of which cement-lined pits, 2 ft. 5 ins. deep, are provided, to enable the men to work under cars. In one end of the carpenter shop the mill machinery is located, and is complete for the manufacture or repair of cars.

The two buildings just mentioned stand in line with one another, which from end to end is 711 ft. long. Parallel to this line, and at a distance of about 100 ft., are first, the paint shop, which is 300 ft. long, 100 ft. wide and 22 ft. high, and contains twenty tracks for the reception of either broad or narrow gage cars; next, the car repair shop and winding room building, which is 360 ft. long, 100 ft. wide, and 22 ft. high in the clear; 80 ft. is partitioned off at one end for the winding room, and through this room a track for either broad or narrow gage cars is provided. In the car repair department there are eighteen tracks, for either broad or narrow gage cars, and all the tracks are over cement-lined pits for better access to the trucks. All the pits throughout the shops are connected to sewers for the disposal of wash water.

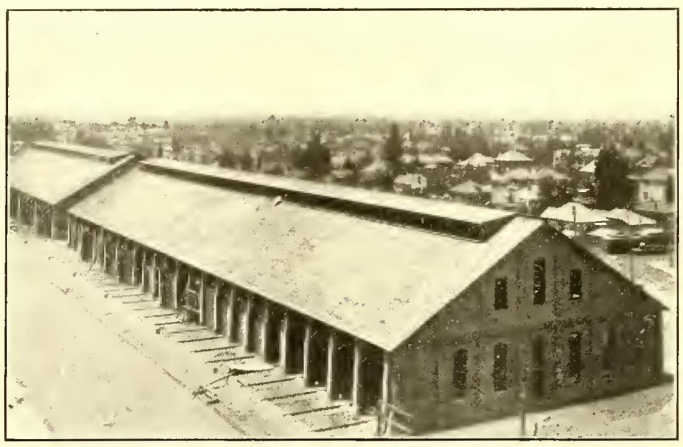
Between the two rows of shops mentioned there is a transfer table 60 ft. long, capable of transporting a fully-loaded broad-gage freight car, containing supplies, and aggregating 160,000 lbs., and its travel is 866 ft. long. This table is novel, in that it has only four wheels, traveling on two rails, and is driven by an electric motor with overhead trolley.



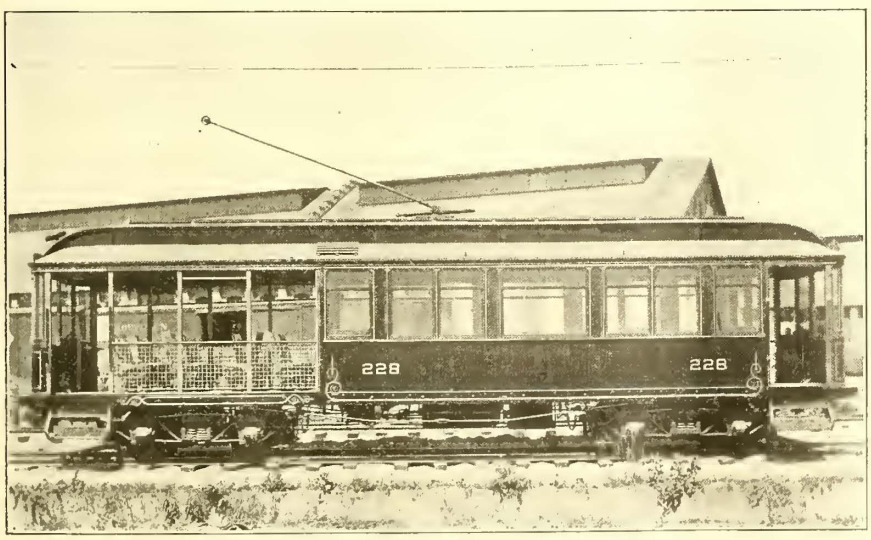
ONE OF THE NEW COMBINATION CARS



MACHINE AND CARPENTER SHOPS



REPAIR AND PAINT SHOP



CAR BUILT FOR PASADENA SERVICE

The fifth building contains an 80-hp boiler for the steam hammers and dry kilns, and also contains on the lower floor the hardwood lumber storage, while the second floor is devoted to a fully equipped pattern shop. This building is 200 ft. long, 60 ft. wide, and two stories high.

The sixth building is the oil house, 40 ft. long, 34 ft. wide, with basement 10 ft. high. The building is one story high. The oil is handled either by gravity or compressed air, as may be most convenient. Oil is used for the ordinary purposes, and also for firing the boiler when the mill refuse is not sufficient and for all blacksmith shop fires.

The seventh building, soon to be in readiness, is a brass and iron foundry, 200 ft. long, 100 ft. wide, and 30 ft. high, provided with all the tools and appliances for such work in connection with the manufacture and repair of cars.

There has also been constructed a car house 263 ft. long, 264 ft. wide, and 18 ft. high in the clear. There are twenty tracks in this building, each 257 ft. long, for the storage and inspection of cars, and inspection pits are provided under all the tracks.

The shops are provided with full fire service hydrants and hose. Each department throughout has its own wash rooms and waterclosets, convenient to the inspection of the several foremen.

The officers of the company are: President, H. E. Huntington; vice-president, Epes Randolph; secretary, E. E. Bacon; treasurer, I. W. Hellman. F. Van Vranken is superintendent of the Los Angeles plant, and W. H. Smith superintendent of the Passadena

NEW CAR HOUSE UNDER CONSTRUCTION

station. G. E. Pillsbury is chief engineer and S. H. Anderson, chief electrician. C. E. Donnatin is superintendent of the mechanical department.

Chicago Elevated Traffic for First Half 1902

The reports from three of the elevated railroads of Chicago for the first half of 1902 show passengers carried as follows:

SOUTH SIDE ELEVATED

Month	1902	1901	Increase	Per Cent
January	79,154	71,137	8,017	11.2
February	79,386	74,525	4,861	6.5
March	80,313	76,269	4,044	5.3
April	81,009	77,772	3,237	4.2
May	76,063	74,205	1,858	2.5
June	76,449	69,645	6,804	9.7
July	70,767	63,763	7,004	10.9

METROPOLITAN ELEVATED

Month	1902	1901	Increase	Per Cent
January	98,029	89,699	8,339	9.3
February	100,466	97,659	2,807	2.8
March	105,512	98,339	7,173	7.3
April	109,246	97,018	12,228	12.6
May	105,799	92,579	13,227	14.2
June	101,743	86,179	15,564	18.0
July	97,929	79,308	18,621	23.4

NORTHWESTERN ELEVATED

Month	1902	1901	Increase	Per Cent
January	62,010	52,022	9,988	19.5
February	64,760	55,256	9,504	17.2
March	65,362	57,193	8,169	14.3
April	65,430	58,623	6,807	11.6
May	63,199	56,399	6,200	10.8
June	60,813	53,587	7,226	13.4
July	56,110	48,559	7,551	15.5

Advertising Trolley Excursions in Cleveland

The Cleveland Electric Railway Company has given especial attention during the past season to the development of the excursion business on its system, and as the lines of the company reach a large number of popular parks and pleasure resorts, as well as the five principal cemeteries in the city, the work of working up the business has been an extensive one. To obtain the best results from this business a special department has been established, called the Outing Department, and has been placed in charge of J. W. Butler.

One of Mr. Butler's methods has been that of printing a large number of attractive flyers, giving the points of interest which can be reached from any point in the city by means of a 5-cent fare. This is called "Nickel Outings to Cleveland's Public Parks, Boulevards, Pleasure Resorts and Points of Interest," and the flyer mentions the route to take and as well describes any principal attraction, such as a band concert, which may be given at any particular park.

Another plan was to make an arrangement with the daily papers by which each one printed a "return coupon," good as passage on the cars in returning from a certain park which the company wished particularly to advertise. The result of this policy has been to develop greatly the excursion business of the company.

Proposed Changes in New Orleans Railways

The New Orleans Railways Company has submitted to the Mayor and City Council a general plan for the reorganization of the transportation system of the city. The management has given the problem its undivided attention since acquiring the properties, and it is believed that the plan proposed will relieve the present congestion of traffic on Canal Street and greatly improve the service throughout the entire city. The company is convinced that the adoption of the plan, which will enable it to make minor connections at intersecting streets, between existing tracks, short excursion routes, and changes in the system of operating cars, will bring about at once greater rapidity in transit, greater convenience and less expense to patrons and increased safty to pedestrians. Cross-overs on Canal Street, the merging of Napoleon Avenue line into New Lake Road, and the extension of Claiborne line to Poland Street are the main features of the plan proposed.

It is a well-known fact that Canal Street in New Orleans presents one of the most difficult problems in street railway operation that has yet been encountered, and it is rapidly becoming worse in proportion to the growth of the city and extension of the street railway lines. The trouble arises from the fact that all lines lead to Canal Street—an admirable feature in the days when few lines were operated—and these were owned by independent interests, but under existing conditions there is, of course, no valid reason for continuing the plan and every reason for abolishing it. In the first place the city has outgrown the idea that all business must be centralized in one particular spot in the town, and that all cars must therefore lead to that district. Moreover, the company now proposes a transfer system that will not only enable all passengers to reach Canal Street, but will give them facilities for reaching other parts of the town for a single fare, when at present two or three fares would be charged for making the same trip. By changing the routes somewhat the present congestion of traffic on Canal Street could be avoided, or at least materially lessened, so as to make unnecessary the delays and blockades of that thoroughfare, which are now unavoidable. An idea of the condition of this street may be gained by examining the accompanying reproduction of a photograph, which fairly represents ordinary conditions on that route. There are six tracks on the street, and their capacity is constantly taxed. It is largely for the purpose of affording relief upon this thoroughfare that the company proposes the following plan, which is now under consideration:

Tchoupitoulas line, Levee and Barracks line: The privilege to connect, by tracks across Canal Street, the tracks of the Tchoupitoulas line, on Tchoupitoulas and South Peters Streets, with the tracks of the Levee and Barracks line, on North Peters Street, and to make the terminus of the Levee and Barracks line on Poland Street, Dauphine, instead of Rampart Street.

Annunciation and Erato line, City Park line of Orleans Railroad Company: The privilege to connect by a curve track, the down track of the Annunciation and Erato line with the down track of the City Park line of the Orleans Railroad Company, at Canal and St. Charles Streets, to connect by a curve track the up track of the Annunciation and Erato line with the City Park line of the Orleans Railroad Company at Canal and Carondelet Streets, and the privilege to change the direction of the running of cars on Laurel and Constance Streets between Louisiana Avenue and Valmont Street.

Magazine line, Camp and Prytania lines: The privilege to connect by a curve track the down track of the Magazine line with the up track of the Camp and Prytania line at Canal and Camp Streets.

Henry Clay Avenue line, Coliseum line, Camp and Prytania line, Broad Street line of Orleans Railroad Company: The privilege to connect by a track across Louisiana Avenue the up track (to be used as a down track) of the Henry Clay Avenue line on Camp Street (to be used as a down track) with the down track of the Coliseum line on Camp Street, to connect the up track of Coliseum line on Chestnut Street by a track on the neutral ground of Louisiana Avenue, with the down track (to be used as an up track) of the Henry Clay Avenue line on Coliseum Street, to operate cars down Camp Street from Calliope to Canal Streets, and to connect the down track of the Camp and Prytania line with the down track of the Broad Street line of the Orleans Railroad Company, at Canal and Camp Streets, and the up track of the Broad Street line of the Orleans Railroad Company with the up track of the Coliseum line at Canal and Carondelet Streets.

Peters Avenue line, Henry Clay Avenue line, Rampart and Dauphine line: The privilege to connect by a track on Peters Avenue, from Magazine Street to Constance Street, and a track across Louisiana Avenue at Dryades Street, the up track (to be used as a down track) of the Peters Avenue line, and the down track of the Henry Clay Avenue line, and by a track across Louisiana

at Baronne Street, the up track of the Henry Clay Avenue line with the down track (to be used as an up track) of the Peters Avenue line, and to connect the down track of the Henry Clay Avenue line with the down track of the Rampart and Dauphine line at Canal and St. Charles Streets, and the up track of the Rampart and Dauphine line with the up track of the Henry Clay Avenue line at Canal and Carondelet Streets.

Louisiana Avenue line: The privilege to connect, by short pieces of straight track, existing tracks on the neutral ground of Louisiana Avenue, and to operate the cars of the Peters Avenue line thereon out Louisiana Avenue, between Freret Street and Tchoupitoulas Street, and to connect the down track of the Peters Avenue line on Dryades, at Canal Street, with the up track of Peters Avenue line on Canal Street.

Villere Street line, Canal and Lake line: The privileges to extend the tracks of the Villere Street line down Villere Street, from Lafayette Avenue to Port Street, to connect (for emergency purposes) the track on Villere Street with the tracks of the Rampart and Dauphine line on Rampart Street and Dauphine Street by a track on Port Street, and to discontinue the operation of cars of the Villere Street line on Lafayette Avenue, from Villere Street to St. Claude Street. Lafayette Avenue, between Villere Street and St. Claude Street, will be well served by cars of the Claiborne Street line, to which free transfers will be furnished under the general transfer system hereinafter proposed.

Esplanade and French Market line: To discontinue the operation of the cars of the French Market line on North Peters Street, from Esplanade to Canal Street, and to operate this line on Esplanade Avenue, between Villere Street and North Peters Street.

Bayou St. John line, French Market line of the Orleans Railroad Company, South Peters line: The privilege to discontinue the operation of the cars of the Bayou St. John line, and French Market line of the Orleans Railroad Company and the South Peters line.

Although at the time this proposition was prepared the New Orleans Railways Company had not acquired possession and administration of the franchises of the New Orleans and Carrollton Railroad, it was understood that the franchises referred to would pass into its hands, and the management therefore further asked the following:

St. Charles Avenue Belt line, Tulane Belt line: The privilege to connect by curve tracks the tracks of the Tulane Belt line on the neutral ground of Canal Street and the tracks of the St. Charles Avenue Belt line on Baronne Street by curve tracks at Canal and Baronne Streets.

Jackson Avenue line, Claiborne Avenue line: The privilege of operating the cars of the Jackson Avenue line over the tracks of the Claiborne Avenue line.

Napoleon Avenue line: The privilege to connect by tracks across St. Charles Avenue the tracks of the Napoleon Avenue line with the tracks to be constructed by the New Orleans and Pontchartrain Railroad on Napoleon Avenue, to operate the cars of the Napoleon Avenue line and the cars of the New Orleans and Pontchartrain Railroad Company as a combined passenger system, and to discontinue the operation of the cars of the Napoleon Avenue line on St. Charles Avenue, Baronne and Canal Streets.

The company also asks the privilege for all cars to take on and let off passengers at near side crossings on Canal Street, so as to avoid the loss of time resulting from two stops.

In return for these concessions the company agrees to establish immediately and always maintain a general transfer system, providing one transfer for one fare on any line to any other line which is crossed.

To establish immediately and always maintain properly graded, grassed and trimmed neutral grounds on Metairie Road, from Canal Street to Bayou St. John, and on Dryades Street, from St. Andrew to Howard Avenues.

To pay (without, however, any admission of liability therefor)

VIEW OF CANAL STREET, NEW ORLEANS, SHOWING PRESENT CONGESTION OF STREET RAILWAY TRAFFIC

the entire cost to the city of New Orleans of the work heretofore done in raising the tracks on Prytania Street, from Philip Street to Louisiana Avenue.

To furnish orchestra music at Audubon Park and City Park on Sundays, commencing the first Sunday in May and ending the last Sunday in August each year.

To extend the Claiborne tracks down St. Claude Street to Poland Street, and to operate the cars of that line over the extension, and otherwise to improve and extend the service.

The accompanying engraving shows what the condition of affairs is now and the desirability of the relief possible by continuing the lines across town. At certain periods of the year most of the processions and displays take place on Canal Street, and the crowd increases to such an extent that the Mayor of the city has been forced to induce the various street railway companies to discontinue operating on Canal Street during the periods of these processions. The effect of granting the permission requested by the New Orleans Railways Company would be to relieve this congestion and give as good service as it was before. The illustration was taken at 9 o'clock in the morning, and illustrates a number of tracks and cars on the street, the latter being sufficient in number at times to almost cause an interruption in crossing the street from one side to the other. The merchants on either side hail this application with a great deal of satisfaction, and its introduction by the New Orleans Railways Company, who is progressive in its movement, will give to the shoppers the opportunity of crossing the street without fear of danger.

In a circular letter, under date of July 17, the New Orleans Railways Company announces the following officers for the management of the several departments, as well as the executive staff: General officers—H. H. Pearson, Jr., president; Charles H. Ledlie, first vice-president; Joseph H. De Grange, second vice-president. Departments—Captain John G. Woods, general manager railway department; Bankson Taylor, general manager gas department; Alexander Black, chief engineer and electrical department; E. B. McKinney, superintendent power houses; H. A. Ferrandou, auditor of the City & Orleans railroad companies; E. J. Morris, master mechanic; John R. McGivney, purchasing agent, and W. H. Renaud, claim agent. These gentlemen will organize their departments, reporting to the president for instructions. Other department appointments will be named later, and for the present the old officials and employees will continue in their respective positions.

Street Car Brakes*

BY M. POETZ,

Chief Engineer of the "Strassen-Eisenbahn-Gesellschaft," of Hamburg

From circular letters sent by the writer to members of the union asking for information on the subject of brakes, only twenty replied, viz: The Aachener Kleinbahn-Gesellschaft, Elektrische Strassenbahn Barmen-Elberfeld, Grosse Berliner Strassenbahn, Strassen-Eisenbahn-Gesellschaft in Braunschweig, Tramways Bruxellois, Société d'Entreprise Générale de Travaux, Frederiksberg Sporvejs-og Elektricitëts Aktieselskab, Strassenbahn Hannover, Kristiania Sporveisselskab, Grosse Leipziger Strassenbahn-Gesellschaft, Leipziger Elektrische Strassenbahn, Tramways Liégeois, Magdeburger Strassen-Eisenbahn-Gesellschaft, Münchener Trambahn, Nürnberg-Fürther Strassenbahn-Gesellschaft, Stettiner Strassen-Eisenbahn-Gesellschaft, Strassburger Strassenbahn-Gesellschaft, Société Nationale des Chemins de fer vicinaux de Bruxelles, Städtische Strassenbahn Zürich, and Strassen-Eisenbahn-Gesellschaft Hamburg.

All the companies named, with the exception of the Strassburger Strassenbahn-Gesellschaft, and the Société Nationale des Chemins de fer Vicinaux possess electric traction, while those two companies employ on their line traction partly by steam locomotives and partly by electricity. Steam traction is used principally on the suburban lines of the chemins de fer vicinaux, and electric traction on its urban lines.

In only a few instances have precise local statutes been passed on the subject of braking. We have received the following communications on this subject:

Aachener Kleinbahn-Gesellschaft.—It must be proved to the authorities that the power of the brake is sufficient to stop the train within a distance which does not exceed the length of the portion of the line illuminated by the headlight of the train.

Grosse Berliner Strassenbahn.—Continuous brakes are prescribed. At first electromagnetic brakes were specified, but at the present, compressed air brakes are also permitted, and a great number of cars are already equipped with them.

Strassenbahn Hannover.—The rules require a continuous brake, which can be worked from the front platform.

Kristiania Sporveisselskab.—Where the brake cannot be worked from both platforms, or where a continuous brake does not exist, each trailer car must be attended not only by a conductor, but also by a brakeman.

Grosse Leipziger Strassenbahn and Elektrische Strassenbahn, Leipzig.—The rules prescribe a brakeman on each car, or else, a continuous brake.

Nürnberg-Fürther Strassenbahn.—The compressed air brakes, with which a certain number of cars are furnished, are prescribed by the authorities.

Stettiner Strassen-Eisenbahn-Gesellschaft.—The rules only prescribe a brake without specifying the system.

In most cases the authorities have left the choice of the system of brakes to be adopted, entirely to the tramway companies, and have limited themselves to approving the system employed.

The companies have expressed themselves as follows in regard to the brakes they are using:

1. Hand Brakes.—Aachener Kleinbahn-Gesellschaft.—Screw brakes are sufficient when they work properly, to stop rapidly a motor car. The screw brakes which were first used on the cars have been replaced by simple chain brakes with sprocket wheels, because with this latter system the conductor has greater control over his brake, and can apply it in shorter time. Besides, dust and wear are destructive to the screw brake.

Strassenbahn Hannover.—The hand brake works well and surely. It presents, however, inconvenience that it acts only on the motor car, and that its quick working depends too much on the promptness of its application.

Kristiania Sporveisselskab.—Chain brakes are not adapted to all the climatic conditions. At times the cars slide over the rails with the wheels skidding, while again braking becomes impossible in spite of the efforts of the conductor, on account of the snow which gets between the shoes and the wheels. Under these conditions the use of costly air brakes would hardly improve our conditions. These inconveniences are less with the electric systems.

Tramways Liégeois.—Chain brakes are sufficient on lines with few grades, provided that the chains are carefully inspected.

Magdeburger Strassen-Eisenbahn-Gesellschaft.—Hand brakes have the disadvantage of increasing the working expenses on account of wear, but they have the advantage of facilitating operations.

2. Electric Brakes.—Grosse Berliner Strassenbahn.—An inconvenience of the magnetic brake consists in the continual strain put on the field coils and commutators by which they get overheated. There is also great wear on the discs, and frequent breaking of the connections, which entails great expense.

Frederiksberg Sporveis-og Elektricitëts Aktieselskab.—Short-circuit brakes employed simultaneously with hand brakes give excellent results.

Strassenbahn Hannover.—The short-circuit break often acts too quickly, and causes the wheels to skid. This system of braking has also the disadvantage that it brakes only one axle when the car possess only a single motor. The reverse-current brake has the same disadvantages, and entails a certain expense, because the current is taken from the overhead conduit.

Kristiania Sporveisselskab.—Electric brakes are less affected by snow than hand brakes and air brakes (see hand brakes). An objection against it is the impossibility of stopping the car completely by the electric brake, on account of which it is always necessary to have recourse to another brake, which we consider inconvenient. It is well to add that the motors are subjected to great strain, without periods of rest, which is undesirable, especially in summer.

Magdeburger Strassenbahn-Gesellschaft. — The short-circuit brakes are expensive, on account of the repairs which it entails to the armature, coils, etc. Electromagnetic brakes wear out fewer discs, and enable the driver to stop the train, it may be said, instantaneously.

Nürnberg-Fürther Strassenbahn-Gesellschaft.—We consider a good hand brake used simultaneously with a short-circuit brake as emergency brake, or vice-versa, as being the best braking device. If there are free axles without motors, they must be braked electromagnetically. This system presents the advantage that on all the down grades the two brakes must be always employed, which guarantees their constant working; besides this arrangement offers the least hindrance to the progress of the vehicle.

Städtische Strassenbahn Zürich.—We consider that the two brakes (hand brake and electric brake) are absolutely indispensa-

* Abstract of paper read at the meeting of the International Tramways Union, London, July 3, 1902.

ble for a city tramway. Frequent use of the electric brake causes more rapid wear of the pieces on which it works, above all if it is put in force quickly when running at great speed.

3. Pneumatic Brakes.—Aachener Kleinbahn Gesellschaft.—We have discontinued the use of compressed air and similar brakes, chiefly for want of space, and also because of the difficulty of maintaining the pressure of the air and the freezing in winter which weakened the reliability of the working of the brake. The necessity of constant and minute examination by an experienced staff raises the cost of the maintenance of the brakes, etc., and finally the increase in the weight of the cars constitutes a serious inconvenience.

Grosse Berliner Strassenbahn.—The compressed air brake has not as yet manifested any disadvantages, and it has the advantage over the magnetic brake in the smallness of the repairs it requires.

Tramways Bruxellois.—The Westinghouse brake has the advantage of working surely and efficaciously. It necessitates a certain upkeep, and some expense, which is, however, much less than the wages of the brakemen, with which it dispenses.

Strassenbahn Hannover.—The Carpenter brake consumes some power for the compression of the air, but on the other hand, it works quickly and forcibly, stopping the whole train at once.

Grosse Leipziger Strassenbahn.—The experience which we have acquired with this brake (compressed air brake of the Standard Air Brake Company) during a working period of five years, has been entirely satisfactory and its upkeep is so simple and inexpensive that we have resolved on keeping to the same system when ordering all our new cars.

Münchener Trambahn.—We have adopted, on our own initiative, the air brake, and it works in a perfect manner, only, in winter, when it is very cold, the brake valves are sometimes frozen, and it becomes necessary to replace the car. However, the car can be put again in operation at the end of five minutes.

Nürnberg-Fürther Strassenbahn-Gesellschaft. — We consider that the electromagnetic brakes and air brakes stand about equal in point of merit, if we omit the question of first cost and maintenance charges (the air compressors consume a considerable amount of electrical energy).

4. Friction Brakes.—Leipziger Elektrische Strassenbahn.—This brake presents the advantage that it is actuated by means of the handle by a slight movement and without any effort, and that the inertia of the car itself is used for the braking. This brake is notable for its low cost.

The conclusions reached by the writer from the foregoing letters, and from his own experience, are as follows:

1. Hand Brake.—With chain brakes, the gearing ratio generally adopted between the handle and the shoes is as 1 : 80 or 1 : 100. Experimental tests have shown that, when light double axle cars are operated, running at the maximum permissible speed in the interior of towns (which is not very high), these brakes are sufficient under ordinary conditions, it being understood that no trailers are handled. In northern countries the efficiency of the brake is liable to be reduced by the fact of the snow getting between the shoes and the wheels. Otherwise this brake answers to the general requirements.

This brake is easily inspected and regulated. It is likewise easy to remove the worn parts; and the maintenance cost is low.

With the screw brake the gearing ratio can be carried to above 1 : 100, but a great inconvenience results therefrom, from the fact that it is brought so much the less quickly into operation. This cannot be permitted, considering the risks inherent to tramway operation. Another serious drawback is the wear caused by the street mud and dust upon the screw; this reduces the efficiency of the brake. Consequently, this brake cannot be relied upon as a regular service brake, and ought only to be considered as a safety brake.

2. Electric Brakes.—So far as ordinary service is concerned, the short circuit and electromagnetic brakes worked by the current set up by the motion of the cars, can only be considered. The reverse-current and electromagnetic devices which are actuated by the line current are mere emergency brakes. As the short circuit and electromagnetic brakes worked by the current set up by the car's motion, cannot bring the car or train to a perfect stop, it will be of advantage, especially on grades, to work them together with the hand brake. In such a case, a very small effort is required from the motorman to set the hand brakes. When the car must be stopped by the electric brakes alone, the current must be derived directly from the line.

It is of the utmost importance that all the axles of a train should be braked whenever quick stops are a condition of safe operation. Experience has shown that short-circuit brakes are capable of exciting a very strong braking action. When the motor cars run single and all axles are driven, the short-circuit brake will, as a general rule, answer every purpose of a reliable service brake; it being understood that the hand brake is also available. Under special easy and favorable conditions, the short-circuit brake can still be relied upon if only one axle is driven. When trailers are used, all their axles must be braked whenever stopping within short distances is required.

The electric brake, when compared with the ordinary brake, requires no effort, and, consequently, does not exhaust the motorman. This point is of importance, especially when high speeds are reached and when the street traffic is congested; as a physically exhausted motorman is liable to be inattentive and lose that presence of mind which is, above all, necessary to him.

The brake being actuated by a short motion of the handle, the action is very quick, which is of importance in cases of emergency. Provided a good regulation of the resistances is devised and the motorman has some practice, the stoppage is very smooth. The simultaneous working of the hand brake with the electric brake is also of advantage, as it keeps both systems in proper working condition.

As to the other advantages claimed by the electric brakes, the opinions widely differ. A number of companies consider that the brake is hard on the motors and entails heavy repairs for armature coils. As for the electromagnetic brake, the Grosse Berliner Strassenbahn states that the wear on the discs and the frequent breakings of the electromagnet leads cause very great repair expenses. It is to be regretted that no statistics concerning these changes are given. The experience which the Hamburg Strassen-Eisenbahn-Gesellschaft has had with the simultaneous use of short-circuit and electromagnetic brakes, as ordinary service brakes, on all its cars, is highly satisfactory. This company has not experienced any increase in the repairs to motors, switches, gear wheels, etc.; moreover, no magnet lead of the electromagnetic brake has as yet been broken. The faults found with these systems seem more likely to be due to want of sound construction or of the proper proportioning of the resistances.

3. Pneumatic Brakes.—The compressed air brake has the advantage over the electric brake that any number of trailer cars can be added to a train and braked without inconvenience. On the other hand, the following drawbacks can be cited against them; higher cost of installation, necessity of a special controlling handle, increase in the working expenses caused by the compression of the air, necessity of a minute inspection of the compressors and valves, etc., the freezing of the pipes, and the reduction in the braking efficiency when the snow gets between the shoes and wheels.

All the companies which use air brakes, however, express themselves as satisfied with their working. A particularly interesting statement is that made by the Nürnberg-Fürth Tramways who, it is remembered, make use of both the electromagnetic and the compressed air brakes. We will once more produce its statement here: "We believe that the electromagnetic and compressed air brakes stand about equal in point of merit, if we omit first cost and maintenance charges."

4. Friction Brake of the Elektrische Strassenbahn Leipzig.—I have nothing particular to mention here with regards to this system.

Taking all the evidence at our disposal into consideration we conclude that the mechanical efficiency of the air and electric is equal when the motor car hauls but one or two not too heavy trailers. When the number of trailers is greater than this number, preference must, by all means, be given to the compressed air brake, because the short-circuit current set up in the car would not, under such conditions, be sufficient to brake the train. So far as reliability is concerned, it must be admitted that the electric brake, owing to its greater simplicity, will be less frequently disabled than the air brake which is far more complicated and is composed of various parts, some of which are very delicate. The freezing of the pipes and valves is a great inconvenience of the air brake. It is also more natural that an electric car should be braked directly by electricity instead of actuating air compressors by electricity first and then using this compressed air for the braking.

We do not possess any certain statistics on the financial part of the question by which the advantage of one system over the other can be stated. The air brakes are likely to entail greater first and maintenance cost than the electric brakes. It is of a general interest to get full information on this matter.

A bad accident occurred Aug. 19 on the Jerome Avenue line of the Union Railway Company, of New York, when a large open car left the track near the foot of the Jerome Avenue hill and fell into a ditch. Several persons were injured. It is thought that recent rains covered the track with sand, and this derailed the car.

Systems of Mechanical Traction for Street Railways*

BY E. A. ZIFFER, of Vienna

Reports on this subject were presented by the writer at the meetings for this Union held at Cologne, 1894; Stockholm, 1896; and Geneva, 1898; and the systems in use at that time were fully described. Although a number of improvements have been made since that time, only a few companies have replied to the circular letter sent by the reporter, asking for information. The small number of these replies was undoubtedly due to the fact that most of the companies in the Union employ the trolley system, and hence had made no experiments with any other method. A general summary of the different systems in most common use, outside the trolley, follows:

ELECTRIC CONDUIT SYSTEM

The first application of this system took place in 1885, when Walter H. Knight installed a short line in Cleveland and H. M. Smith one in Blackpool. The commercial history of the system, however, really dates from the installation in Budapest, by Siemens & Halske, which has been in continuous service for fourteen years, and where there are now 60 km of track. The conductors in this system have been modified from the original form, so that they are now T-irons with a flat, vertical rubbing surface. The cost of construction per km is 109,000 francs. The same firm has also built lines in Berlin and Vienna, the latter having been put in operation during the last twelve months. There are, in Vienna, 23.3 km of track and they are working very satisfactorily. The Union Elektricitäts-Gesellschaft, of Berlin, has also built a line, in that city, 876 m in length. The Metropolitan Railway Company, of Washington, and the Metropolitan Street Railway Company, of New York, also have conduit systems in which the conduit is placed in the middle of the track instead of under one rail, as in the European systems. This method is more expensive than the European system, which requires less excavation, and with which there is less iron in the street, and switching is more easy. On the other hand, the side conduit requires a slot of greater diameter. In Washington, the installation of the conduit system cost 178,000 fr. per km of single track, and in England 164,000 fr. The Brussels Tramway is now installing the conduit system on a considerable length of its track, and has had two lines in operation since 1897. According to this company, the cost of installation is estimated at 100,000 fr. per km, not including the cost of repaving or of moving underground pipes. These latter figures depend upon local conditions, and in the case of the Brussels Tramway amounted to 60,000 fr. per car in service. The maintenance of the conduit in Brussels, which has 10 km of double track; that is, 20 km of single track, including the inspection of insulators, cables, etc., requires eleven men per day. The Brussels Tramways Company gives the following as the cost of operation in francs per car km for traction:

	Conduit Lines. Francs.	Trolley Lines. Francs.
a. Cost of current	0.0400 (1)	0.0570 (1)
b. Maintenance of track, excluding paving	0.0147	0.0174
c. Maintenance of rolling stock	0.0703	0.0516
d. Miscellaneous (including maintenance of paving)	0.0172	0.0023
Total	0.1422	0.1383

This table shows that there is very little difference between the cost of operation of the two systems. The insulation of the conductors varies greatly with the climatic conditions. Accidents are more frequent with the conduit system, on account of the liability of trouble to the plow, which costs, complete, about 50 fr. These troubles, however, have been rare in Brussels.

According to information furnished by the Compagnie Générale Parisienne de Tramways, it has applied the conduit to three lines within the city of Paris. These lines have a length of 10.5 km of double track and were built with a side conduit by the Compagnie Française Thomson-Houston in 1900. The cost of these lines averaged 265,000 fr. per km of single track. In this sum are included the cost of paving, which amounted to 60,000 fr. per km, the conduit with its accessories, the cost of removal of water pipes, etc. Based on the number of cars in service, the cost of installation amounted to 85,700 fr. per car. The cars run are single-deck cars with four-wheel trucks, and are equipped with two 40-hp motors. The difference in power consumption between this system and the trolley system is practically insignificant. The cost of maintenance is also practically the same as that for the trolley system, except the expense of cleaning the conduit, which amounted to about 2100 fr. per km of single track per year. The plow can be raised or lowered from the car by means of a winch placed on the side of the car. The conduit is under one of the rails, except at switches, where it is placed in the center of the track. Experience with the construction of the Bastille-Chareton line indicated that the cost of construction amounted to about 230,000 fr. per km of single track, and that the cost per car km was between 0.36 fr. and 0.59 fr.

The first conduit line in Budapest was put in operation July 30, 1889 and cost between 64,000 fr. and 106,000 fr. per km of single track, not counting crossings or changes in locations. In 1901 the trolley and conduit lines in that city comprised a total of 70.623 km, with 142 four-wheeled cars and 22 eight-wheeled motor cars. The cost of the cars varied between 14,800 fr. and 21,000 fr., and they required from 500 to 1000 watt-hours per car km. The cost of operation of the trolley and conduit lines is not kept separately. The company ran, during 1901, 6,386,832 car km at a cost of 0.2431 fr. per car km.

According to Siemens & Halske, who are operating the Vienna tramway system, the length of conduit lines in that city is 12.5 km of double track, or 23.3 km of conduit. During the present year, 2.7 km of trolley will be transformed into conduit. The conduit is located under one of the rails, so that the cars have to be fitted with two plows, one on each side, so that either one can be used. The cost of installation has not yet been determined. Both double and single-truck cars are employed.

According to a recent report presented to the city of Sheffield by a committee appointed to examine into the conduit system in eighteen cities, the cost of installation in the different cities per km was as follows:

Berlin	102,000 francs
Blackpool	111,000 francs
Budapest	71,000 to 110,000 francs
Dresden	103,000 francs

SURFACE CONTACT SYSTEMS

The Munich tramways installed the Schuckert conduit system in 1897 on an experimental section 300 m in length. The company reports that the system is considerably more expensive and less reliable than the trolley and mentions among its other objections that of danger of short circuit, in case the car is derailed or the contacts remain alive. Improvements were made by the Schuckert Company, however, in the system, and cars were run regularly over it between November, 1899, and October, 1901. During this time no accident was reported. The first cost of the installation of this system amounted to about 45,000 marks per km, while the cost of operation is practically the same as that of the trolley. The skate is the only part of the apparatus which shows much wear; it will last about 10,000 km and costs only 20 marks to replace. Other surface contact systems almost without number have been devised, but the writer will refer briefly to only a few of them.

The Claret-Vuilleumier was installed for the first time in Lyons in 1894 in a section 3.2 km in length, and was afterward installed on the Paris-Romainville line. The cost in the latter case amounted to 21,547 fr. per km of single track. The General Electric Company has installed a short system at Monaco 4.5 km in length and having a gage of 1 m.

The Diatto system is used quite extensively in France, and about 130 km of track have been equipped with it. It was first put in operation in Tours in April, 1898, and has been adopted in Paris by the Compagnie des Tramways de l'Est on 54 km of track, and by the Compagnie Electrique des Tramways de la Rive gauche on 17 km of track. The cost of installation is about 30,000 fr. per km of single track. The system, however, does not seem to give complete satisfaction, and several horses have been injured by it.

The Lorain Steel Company has installed the Brown system at Wolverhampton. The experience in that city has not yet been great enough to determine the actual value of it, and although the service seems to be satisfactory, the traffic is not as large as it would be in a larger city. It should be mentioned here, however, that at Tours, where the traffic is not large, the Diatto system seems to give much better results than in Paris. The difficulties in Paris are aggravated not only by the large traffic, but also by the dampness of the soil in certain quarters of the city.

CONCLUSIONS

A careful examination of the status of the different systems at present and four years ago at the time of the Geneva convention will show that there is very little change to record during the last four years in the status of the conduit or surface contact systems, although the former has been adopted to a considerable extent

* Abstract of paper read at the meeting of the International Tramways Union, London, July 3.

(1) Owing to differences in grades and power of motors.

in some of the largest cities. The side conduit seems preferable to the center conduit as used in America, one great reason for the adoption of the center conduit in America being that that was the style of conduit used with the cable roads. During the last four years some improvements have been made in surface contact systems, but there has been no great increase in the number of roads of this kind, except in the case of the Diatto system in France, where it has not been very satisfactory. The other systems are hardly out of the experimental state; it is, nevertheless, a fact that if such a system could be devised which would be satisfactory, it would supply a real demand for a system which will be more certain and less costly than the conduit.

The writer will say in conclusion that the conduit system at the present state of development is certainly to be preferred to any surface contact system, as the latter cannot be relied upon for continued operation.

London Letter

(From Our Regular Correspondent.)

It seems that, after all, there are to be no embankment tramways, the House of Lords, about the end of last month, having refused to pass the bill already approved by the House of Commons. The Lords seem to imagine that it would be *desecration* to put tramways on the embankment which, as one of the noble lords characteristically put it, is "the finest boulevard in Europe." Lord Newton stated that he considered that a much more practical and sensible way of joining up the tramways of the north and south of the Thames would be by constructing a subway under the river. In spite of all the efforts, therefore, of the London County Council no tramways will be seen on the embankment for some time. There is no doubt, in our opinion, that a tramway on the embankment would greatly relieve the congestion on the Strand, and would thus be of great benefit to London. The work on the Tooting lines of the County Council continues apace, however, and the large section will soon be completed.

The extension of the City & South London Railway from Moorgate to the Angel, Islington, has evidently proved a good paying investment for this company, which was the first tube railway in London. At a recent meeting this company declared a dividend of 3 per cent against 1¾ per cent declared a year ago, and has carried forward a sum this year of £1750 against £732 last year, besides placing a sum of £2000 toward renewals. It is quite clear, therefore, that a tube system can be made to pay, if facilities are granted by Parliament for extensions in the proper directions. This railway would, undoubtedly, have been even more valuable had it been able to get its proposed extension from the Angel to Euston passed, as it would, undoubtedly, have filled a tremendous want, there being very poor communication between the large northern railway stations on the Euston Road and the city and southern portions of London.

The battle of the tubes has been energetically fought during the past month. Practically all the schemes referred to in past issues have passed the second reading. Without going into details again, as most of our readers must now be very familiar with the situation, all of the schemes of the Yerkes group have passed the second reading and practically all the schemes of the Morgan group have also passed the second reading. This will bring those two groups into distinct competition along Piccadilly, the Yerkes group having a bill called the Brompton and Piccadilly Circus Bill, and the Morgan group having a scheme for a tube from Hammersmith by way of Piccadilly and connecting with the northeastern systems. Both of these bills have passed the second reading, though it looks as if some confusion would arise by two tube railways being permitted on the same route. The final decision of these bills will be awaited with great interest.

It has now been abundantly proved that the recent movement of the Metropolitan District Railway Company to considerably reduce its fares was a good move, and it would seem that this should have been done long ago. The gross receipts for a recent week showed a gain of no less than £1556, which would go to show that there is much life in the old railway yet, if the management would wake up and devise substantial means of meeting competition. The rates on this line and on the Metropolitan have been, for the past year or two, absurdly high; now they have been practically cut in two, and the results show a largely increased traffic. It should be an object lesson to other railways in the city with suburban traffic, and it seems to us that even though the City & South London, about which we referred in another note, has succeeded in paying 3 per cent for the past year, that the company would largely increase its business if it would also make substantial reductions, or else adopt a uniform fare. Instead of cars running with only a few passengers, owing to the competition of 'buses and cars the company could easily reduce its prices and have its cars comparatively full at all times, and, as the operating expenses would remain constant, the result would be an increase in the net receipts.

A curious case recently came before the Dudley Police Court when the Dudley & Stourbridge District Electric Traction Company were fined for carrying passengers on the top of a car in defiance of the Light Railway Act to safeguard the public from possible danger from an electrically-charged standard or pole. This will bring up an interesting point, as, if it is proved that it is against the law for passengers to sit on the top of the car in close proximity to a trolley pole, it will result in wholesale changes being necessary. It is not, of course, to be thought for a moment that the decision of the Dudley Police Court will be taken as a guide, and higher authority will be sought in the near future.

An analysis of the atmosphere in the Two-penny Tube has shown that in certain places the air contained 27½ volumes of carbonic acid gas per 10,000 volumes of atmosphere. In a car a sample showed 13 volumes for 10,000, while samples at one of the stations averaged about 13 volumes per 10,000. It should be stated, however, that the sample containing 27 volumes was taken at the top end of a crowded car, which would, undoubtedly, be one of the places most seriously affected. In order to make comparisons, it should be stated that fresh country air contains 3.4 volumes per 10,000, while London streets ordinarily contain about 4.4 , while the clause in the factory act states that not more than 9 volumes of carbonic acid gas per 10,000 volumes of air are permitted in factories. This shows that while the ventilation is not as good as it might be, still the danger is not serious. The Central London Railway Company is, however, making every preparation for improving the atmosphere, and are introducing a system by which it is hoped much better ventilation will be accomplished.

A system of electric tramways is being constructed at Peterborough by the British Electric Traction Company. The lines will extend from the cathedral gateway to the northern suburbs of Walton, Dogsthorpe, and Newark, and will cover 5½ miles. The contractors for laying the rails are J. G. White & Co., of London, and about 100 men are at work on the streets of the city.

A novel feature of the new municipal electric tramways at Yarmouth, which has just commenced running their first full daily service, is a telephone line carried upon the street standards, by means of which, in case of accident or breakdown, the driver or conductor can, with a portable telephone carried on the cars, at once get into communication with the tramway headquarters.

At the offices of the Board of Trade, a conference took place recently between Sir F. Hopwood (the secretary of the department), and Sir Herbert Jekyll (secretary of the railway department), and the representatives of various London and provincial bodies, in reference to the boards of trade regulations regarding the speed of electric tramways. Among the bodies represented were the corporations of Glasgow, Liverpool, Manchester, Leeds, Sheffield, Nottingham, Cardiff, Bradford, Newcastle-on-Tyne, Salford, Bolton, Oldham, Brighton, Halifax, and Hull. As to speed indicators, it was urged that no other carriages were required to carry them, and that they would do little or nothing toward the safe working of the cars. It was further asked that local authorities should be permitted to make regulations as regards speed, that the speeds allowed by the Board be from eight miles to sixteen miles an hour, according to the local traffic and conditions, and not fixed at a maximum of ten miles. Sir Francis Hopwood said the Board was not in favor of hard-and-fast rules. Exceptions had already been made in some cases, where a maximum speed of more than ten miles an hour was allowed. He was disposed to advise the department that no general maximum speed should be fixed, but that the rate should be left to be settled by the inspectors in each case upon its merits. It is believed that the regulations prepared by the department will now be modified in several important particulars.

At a recent meeting of the Tramway Committee of the Aberdeen Town Council, it was decided not to introduce half-penny fares over the system, and to discontinue, forthwith, the half-penny fare hitherto in existence on the Woodside route. It was pointed out that half-penny fares do not pay the corporation.

The new length of tramway lines recently laid down by the Liverpool Corporation from the former Old Swan terminus to the city boundary at Knotty Ash has just been put in service, thus opening up connection with the Prescot Light Railway, which runs from the boundary through Prescot, Rainhill, and Eccleston Park to St. Helens, and then on to Haydock. Mr. C. R. Bellamy (tramway manager) and Mr. C. W. Mallins (traffic superintendent) were present to witness the initial car run to the new terminus. In the meantime Liverpool is exercised over the question of whether they should send a deputation to the United States or not.

A. C. S.

Plotting Speed-Time Curves—V

BY C. O. MAILLOUX

APPENDIX A.

(ANALYTICAL DEFINITIONS.)

TIME-FUNCTION CURVES OF RECTILINEAR MOTION.

Motion and Velocity.—The phenomenon of motion being the natural starting point in the analytical study of the speed-time curve, we may begin by noting some of its characteristics.

According to the definition given by the late Professor S. W. Holman, in his able work on "Matter, Energy, Force and Work" (page 12), "Motion is change of relative position." It is symbolized by distance and may be estimated and measured by reference either to its amount or to its rate.

The amount of motion of a body is equal to the length of the line (called "path") along which the motion takes place.

The rate of motion of a body is the proportional amount of its motion estimated by reference to some basis or unit of comparison. Time being the most convenient and practicable basis of comparison or proportion, the rate of motion, when estimated with reference to time, is equal to the change in amount of motion (or the variation of distance, or space) occurring in a definite interval of time, and it is then called the time rate of motion or the time rate of speed variation. Thus, when distance is expressed in miles, and time values in hours, the rate of motion will be equal to the quotient of the distance divided by the time consumed in moving over the given distance. In this case the quotient would be "miles per hour," which is the numerical measure of speed or velocity. Hence, velocity is equal to the time rate of motion, or

$$v = \frac{ds}{dt} \qquad (a)$$

whose value would be:

$$v = \text{miles} \div \text{hours} = \text{miles per hour}$$

where v = instantaneous velocity or speed (m.p.h.)
s = distance (space)
t = time (seconds)

If, in Fig. 15, the ordinates be used to represent amounts of motion or distances, expressed, say, in feet, and if the abscissæ be used to represent time values, say, in seconds, then the curve O A B C D will represent the relation between any distance and the time required to pass over it by a moving body.

The amount of motion which has taken place between any two points, as A and B, on the curve, will be measured by the vertical distance dy ($= y' - y$) between these two points. This amount of motion has taken place in the space of time dx ($= x' - x$), comprised between the two time intervals x and x'. Hence the amount of motion in unit time (*i. e.*, the time-rate of motion), or the velocity, will be

$$\frac{y' - y}{x' - x} = \frac{dy}{dx} = \text{feet per second.}$$

Let the (dotted) line, $x^\circ - - - z$, be drawn tangent to the middle point of the portion of the curve comprised between the points A and B. Then, by similar triangles, we have

$$\frac{dy}{dx} = \frac{Bx'}{x^\circ x'} = \frac{y'}{(x' - x^\circ)} = \tan B\ x^\circ\ x'$$

A similar relation would obtain in the case of a line drawn tangent to any other point whatever of the curve. Hence, the differential coefficient dy / dx, or the tangent, at any point of the curve, is numerically equal to the time-rate of motion, or the velocity, at that point.

The precise numerical value of the differential coefficient, for any point of the curve, will depend upon the angularity of the tangent line (analogous to the line $x^\circ - - - z$) at that point. For an angle of 90°, corresponding to any portion of the curve having an exactly vertical direction, we have $dx = 0$, while $dy =$ a finite quantity, and consequently, the value of the tangent being infinity (as is well known from trigonometry) we will have

$$\frac{dy}{dx} = \frac{dy}{0} = \tan 90^\circ = v = \text{infinity},$$

that is to say, the velocity will be infinite. For an angle of 0°, corresponding to any portion (D) of the curve which is exactly horizontal, we have $dy = 0$, while $dx =$ a finite quantity, and, consequently, we will have

$$\frac{dy}{dx} = \frac{0}{dx} = \tan 0^\circ = v = \text{zero}$$

that is to say, zero velocity, *i. e.*, absolute rest.

A curve such as shown in Fig. 15 is, in reality, a "distance-time" curve, but is usually called simply a distance curve. From the preceding analysis it will be readily seen that the slope of the curve or the angle which it makes with the axis of x, is an indication and a measure of the velocity of the moving body. It is also an indication of the direction of motion, for, as will be seen, the elemental motion (dy) taking place in the time (dx) is upward, since the space increment (dy) when measured on the scale of ordinates represents the progression from the point y to the point y'.

In Fig. 16 we have a distance-time curve having a general downward slope. In this case, the elemental motion (dy) taking place in the time (dx) is downward, since it represents the pro-

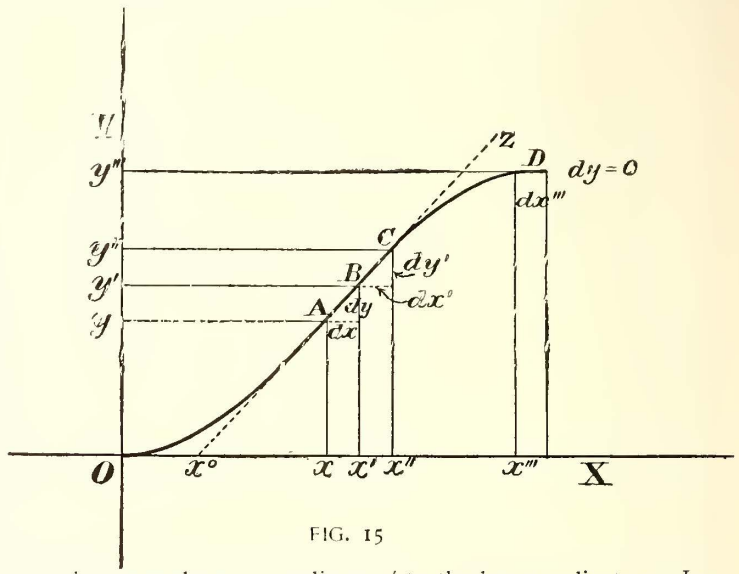


FIG. 15

gression from the upper ordinate y' to the lower ordinate y. In such a case the space increment (dy) would have a negative sign, and, consequently, the differential coefficient $\frac{dy}{dx}$ would have the negative sign.

It follows, therefore, that in any distance-time curve, when the differential coefficient has a positive sign, it indicates motion upward, and when it has a negative sign, it indicates motion downward.

The distance-time curve is related in an interesting manner to the speed-time curve, which we now proceed to consider analytically.

In a speed-time curve (Figs. 1, 2, 3) the ordinate values (y) represent instantaneous values of speed or velocity, as previously stated. We, therefore, have (from equation *a*)

$$y = \frac{ds}{dt} = v \qquad (b)$$

It follows that the ordinates of a speed-time curve are porportional to the differential coefficients, or the tangents, of a corresponding distance-time curve. Reciprocally, since integration is the reverse of differentiation—any distance-time curve may be regarded as the integral curve of a corresponding speed-time curve. This is a very important and useful relation, which may also be established in another manner.

The area (da) enclosed by any small portion of a speed-time curve corresponding to the time-element dt is

$$da = y\ dt$$

Substituting for y, according to equation (b), we have

$$da = \frac{ds\ dt}{dt} = ds \qquad (c)$$

or the elemental area of a speed-time curve is the equivalent of an elemental distance (ds). This elemental distance is equal to the difference in the ordinate values of a corresponding distance-time curve taken between the same time points.

The equivalent of ds, by equation (b), is

$$ds = v\ dt \qquad (d)$$

The integration of the speed-time curve between any two time points such as t° and t', will give

$$A = \int_{t^\circ}^{t'} v\ dt = s \qquad (e)$$

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5; the second part July 26, and contained Figs. 1 to 10; the third part, Aug. 9, and contained Figs. 11 to 13, and the fourth part, Aug. 16, and contained Fig. 14.

in which

A = the area of the portion of the speed-time curve comprised between the time values t° and t',

and

s = the distance traversed in the interval of time t° t'.

By reversing the process, or differentiating, we return readily from equation (e) to equation (d), and thence to equation (b), which was our starting point.

The above relationship between the distance-time and the speed-time curves is utilized to advantage in plotting the "run" curves.

[This relationship was mentioned as early as 1885 by M. Bruno Abdank-Abakanowicz, in one of his serial articles on the "Integraph," published in "La Lumiére Electrique" (Vol. XVIII, pp. 538-539), and reprinted in his work, "Les Intégraphes," 1886, pp. 117-119.]

Variable Velocity and Acceleration.—Velocity, like motion itself, may be estimated by reference either to its amount or to its rate.

I. Amount of Velocity.—The amount of velocity (or the amount of speed) of a moving body, is the difference between

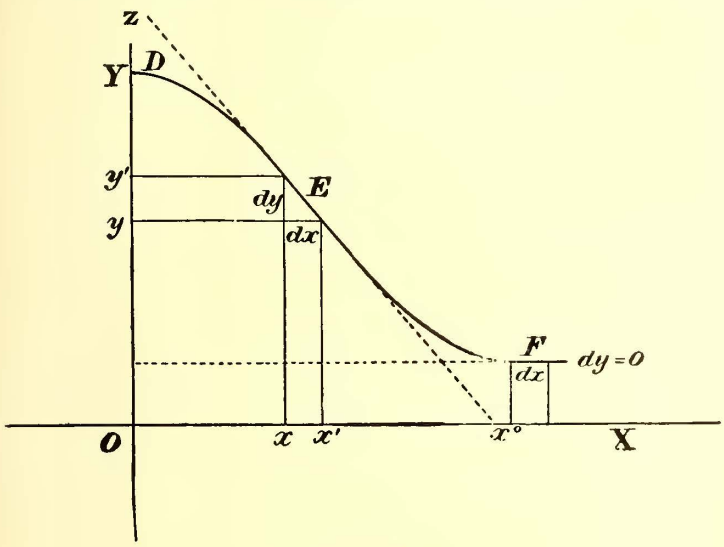


FIG. 16

two definite given velocities of said body. The two velocities by reference to which amount of velocity is determined, are sometimes called the "initial" and "final" states "of motion," or "velocities" of the body.

Equation (a) suggests at once the following analytic definition:

Amount of velocity is the difference between two given time-rates of motion of a body. In symbols we have, for the amount of velocity,

$$v'' = v' - v^\circ = \frac{d\,s^\circ}{dt} - \frac{ds'}{dt} \qquad (f)$$

where

v'' = amount of velocity
v° = initial velocity
v' = final velocity

When the initial velocity v° = zero, we have

$$v'' = v' \qquad (g)$$

In this case the amount of velocity is the total velocity. This is the quantity generally meant when we speak of a speed of so many miles or kilometers per hour, or so many feet or meters per second.

When the initial velocity is lower than the final velocity, equation (f) gives a positive value for v'', and we have a gain or increase in velocity, which is acceleration. The motion taking place under these conditions is called accelerated motion.

The following statements should be carefully noted:

Acceleration is increase in velocity.

It is measured in miles per hour, like velocity.

This is not the usual acceptation of the term acceleration, which, as we shall see later, is used, ordinarily, in a figurative sense, instead of "time-rate of acceleration."

When the initial velocity is higher than the final velocity, then equation (f) gives a negative value for v'', and we then have a loss or decrease in velocity, which is retardation. The motion so conditioned is called retarded motion.

Retardation is decrease of velocity, and is measured in miles per hour, like velocity.

Since a loss or decrease is a negative gain or increase it follows that retardation is, analytically, the same as negative acceleration; and it is in practice often designated by that term.

If the initial and final states of motion are exactly the same, equation (f) gives v'' = 0, and we have "constant" speed or velocity.

In the speed-time curve in Fig. 1, the points A, B, C correspond, respectively, to speeds of 55, 60 and 65 m. p. h. These figures represent the total velocity at the corresponding points. Reckoning from rest or zero velocity there has been an increase in velocity, or an acceleration of 55 m. p. h. at the point A, of 60 m. p. h. at the point B and of 65 m. p. h. at the point C. The gain in velocity or the acceleration between one point and the next is equal to 5 m. p. h.

In Fig. 2 the points A, B, C, D correspond to speeds which are respectively 60, 50, 40 and 30 m. p. h. These figures represent the total velocity as before, but in this case the total velocity decreases from one point to the next, there being a loss of velocity or retardation of 10 m. p. h. between any one point and the next.

It will be noted that the time required to bring about the same acceleration or retardation is not the same between A and B, as between B and C. This shows that acceleration (using the term in the sense hereinabove defined) and retardation are independent of time.

Between the points D and E, in Fig. 1, there is no gain or loss in velocity, or, in other words, there is no acceleration or retardation, the speed line being perfectly horizontal, thereby indicating constant or uniform velocity.

II. Rate of Velocity.—The rate of velocity which is most suitable for practical use is the time-rate of velocity, which is

$$\frac{dv}{dt}$$

where

v = velocity

and

t = time

We at once recognize this as being also the expression for the differential coefficients of a speed-time curve at any point.

Since, according to equation (b), the ordinate of a speed-time curve is already equal to a time-rate of motion, its differential coefficient, or the time rate of variation, at any point of the curve, will be equivalent to the second differential coefficient of a corresponding distance-time curve, or

$$\frac{dv}{dt} = d\,\frac{\left(\frac{ds}{dt}\right)}{dt} = \frac{d_2 s}{dt} \qquad (g)$$

We see at once that while the differential coefficient of the distance-time curve $\frac{ds}{dt}$ = indicated amount of velocity, the differential coefficient of the speed-time curve indicates time-rate of velocity. Since time-rate of velocity is equal to change in amount of speed (or acceleration) per unit time, it follows that it is equal to time-rate of acceleration. We therefore have

$$\frac{dv}{dt} = \frac{d_2 s}{dt^2} = \text{time rate of acceleration.} \qquad (h)$$

for which the term "acceleration" is usually employed. The term "rate of acceleration" or "acceleration rate" would be more proper. The writer has sometimes used the term "acceleration coefficient."

When acceleration is measured in miles per hour, as is usual in this country, we have

$$\frac{dv}{dt} = \frac{\text{Acceleration}}{\text{time}} = \frac{\text{miles per hour}}{\text{seconds}} = \text{miles per hour per second}$$

When $\frac{dv}{dt}$ = 0, we have a horizontal speed line indicating zero acceleration.

When $\frac{dv}{dt}$ = a positive quantity, we have an upward slope in the curve, indicating increase in acceleration.

When $\frac{dv}{dt}$ = a negative quantity, we have a downward slope in the curve, indicating negative acceleration or retardation.

APPENDIX B.

TRAIN ACCELERATION

DERIVATION OF FUNDAMENTAL FORMULÆ

The fundamental formulæ relating to train acceleration are derived directly from the formulæ for mechanical energy and mechanical work.

The mechanical work done by a source of energy in moving a body over a given distance is a measure of the mechanical energy usefully expended in doing this work, and it is equal to the product of the propelling force acting against the body by the distance over which the body has traveled, or

$$E = Fs \tag{1}$$

from which we have

$$F = \frac{E}{s} \tag{1a}$$

where

E = Energy (or work)
F = Force exerted (in causing pressure, push or pull)
s = Distance traveled

The above (1) is the equation of potential energy. When considering the changes of energy in a moving body, especially where the force exerted does not remain constant, the equation may be modified so as to estimate separately the energy for each small element (ds) of the distance traveled, thus:

$$d\,E = \mathrm{F}\,ds \tag{2}$$

the total energy corresponding to the whole distance being, in that case,

$$E = \int_0^s F\,ds$$

The distance factor of the energy developed may be expressed in terms of the velocity of the body at each instant of time. Velocity being, itself, a time-rate of space variation, we have

$$v = \frac{ds}{dt} \tag{3}$$

whence

$$v\,dt = ds \tag{3a}$$

where

v = velocity
t = time

Substituting this value of ds in equation (2) we have

$$d\,E = F\,v\,dt$$

which expresses the change in the mechanical energy imparted to a moving body at each instant of time. We also have

$$\frac{d\,E}{dt} = \mathrm{F}\,v \tag{4}$$

or, "the time-rate of variation of energy is equal to the product of force by velocity."

The kinetic energy of a moving body, according to the well-known formula, is

$$E = \frac{M\,v^2}{2} \tag{5}$$

in which M = the mass of the moving body.

Differentiating with respect to v, we have

$$d\,E = M\,v\,dv$$

which expresses the change in the mechanical energy imparted to a moving body at each change of speed. Dividing by dt, we have

$$\frac{d\,E}{dt} = M\,v\,\frac{dv}{dt} \tag{6}$$

which is another expression for the time-rate of variation of energy.

Equating (4) and (6) we have

$$F\,v = M\,v\,\frac{dv}{dt}$$

whence

$$F = M\,\frac{dv}{dt} \tag{7}$$

but $dv\,/\,dt$ is the time-rate of change of velocity, which is rate of acceleration. (This can be readily seen from equation (3); by differentiating v with respect to s and dividing by dt, we have

$$\frac{dv}{dt} = \frac{d_2s}{dt^2}$$

which is the same as equations (g) and (h), in Appendix A.

Hence, if we designate this time-rate by the symbol A, we obtain the well-known fundamental equation

$$F = M\,A \tag{8}$$

which state that "force is equal to the product of mass by acceleration;" from which we derive

$$A = \frac{F}{M} \tag{9}$$

This equation, which expresses the relation between the acceleration produced in a given mass and the force acting upon it, is the fundamental equation for acceleration. The formula requires modification in order to make it convenient for practical use. The mass (M) should be expressed in terms of weight. The acceleration (A) should be based on increments of velocity, stated in miles per hour, and the force (F) should be expressed as a pull in pounds per ton.

The force of acceleration is usually estimated in "gravity-measure," that is to say, by reference to the acceleration produced in a falling body by the action of gravity.

The distance traveled by a falling body is

$$s = \frac{gt^2}{2} \tag{10}$$

where

g = the acceleration constant due to gravity
t = time (in seconds)
s = distance traveled (in feet)

The velocity of the falling body is

$$\frac{ds}{dt} = gt = v \tag{11}$$

and its acceleration is

$$\frac{d_2s}{dt^2} = g = \frac{dv}{dt} \tag{12}$$

The force exerted by gravity is, by equation (8),

$$F = M\,A = \tag{12a}$$

When a body falls and reaches the end of its fall, its potential energy is all converted into kinetic energy. The equation (1) for potential energy may be written

$$E = s\,w = \text{ft. lbs.}$$

when the force w is expressed in pounds, and the distance s is expressed in feet.

Using equation (5) for the kinetic energy, and equating the two, we have

$$E = \frac{M\,v}{2} = w\,s \tag{13}$$

Substituting for s its value as given in equation (10) the preceding equation becomes

$$\frac{M\,v^2}{2} = \frac{w\,g\,t^2}{2} \tag{14}$$

whence

$$M\,v^2 = w\,g\,t^2$$

Taking the value of v ($= g\,t$) and substituting for v its value as given in equation (11), the above equation becomes

$$M\,g^2\,t^2 = w\,g\,t^2$$

which reduces to

$$M\,g = w \tag{15}$$

whence we have

$$M = \frac{w}{g} \tag{16}$$

The value of g may be taken as

$$g = 32.2$$

so that mass expressed in gravity measure is equivalent to weight in pounds, divided by 32.2, or, we have

$$M = \frac{w}{g} = \frac{w}{32.2} \tag{17}$$

when w is expressed in pounds.

If we substitute this value for M in the fundamental equation (9) for acceleration, we have

$$A = \frac{F}{\frac{w}{32.2}} \tag{18}$$

or

$$A = \frac{32.2\,F}{w} \tag{18a}$$

F being, according to equation (1a), the ratio of the energy to

the distance traveled, that is, the pulling force exerted over said distance. This pulling force is expressed in pounds and speeds are expressed in feet per second, when energy (E) is expressed in foot-pounds and distance (s) is expressed in feet. The above formula (18a), therefore, expresses acceleration as a gain or loss in speed measured in feet per second, obtained during one second, that is to say, the increase or decrease in velocity in feet per second per second. In dealing practically with train acceleration, the speeds are usually estimated in miles per hour, and the gain in speed per second is, as a rule, expressed as the increase or decrease in miles per hour, per second. The formula (18a), therefore, requires to be modified by a conversion factor expressing the relation between an acceleration of a foot per second per second and a mile per hour per second. Since a mile is equal to 5280 ft., and an hour is equal to $60 \times 60 = 3600$ seconds, it follows that a velocity of 1 mile per hour $= \frac{5280}{3600} = 1.467$ ft. per second. Using the letter "A" to indicate acceleration in feet per second per second (as in formula 18), and the letter a to indicate acceleration in miles per hour per second, we have the following equation:

$$A = 1.467a$$

whence

$$a = \frac{A}{1.467}$$

or

$$a = .682A \qquad (19)$$

which means that an acceleration of 1 ft. per second per second is equal to an acceleration of .682 mile per hour per second.

Therefore, substituting the value of A, as given in equation (18), we have

$$a = .682 \times 32.2 \times \frac{F}{w} \qquad (20)$$

in which the numerical value of a is equal to the gain or loss of speed (in miles per hour) per second. If the weight (w) is to be expressed in tons of 2000 lbs., as is the general practice in this country, we must substitute its value such that

$$w = 2000\,W$$

where

$$W = \text{tons (of 2000 lbs.)}$$

and where

$$w = \text{pounds (lbs.)}$$

This means, simply, that the symbol (W) representing weights in tons must be multiplied by 2000 to give the equivalent weight in pounds. Substituting for w its value, in terms of W, the equation for acceleration (20) becomes

$$a = \frac{d^2s}{dt^2} = \frac{(0.682 \times 32.2)\ F}{2000\,W} = \frac{21.96\,F}{2000\,W} = \qquad (21)$$

$$= \frac{.01098\,F}{W} \qquad (21a)$$

Solving for F, we have

$$F = \frac{W\,a}{.01098} = 91.1\,W\,(a) \qquad (22)$$

If we are considering the force (F) corresponding to unit weight ($W = 1$ ton), and unit acceleration ($a = 1$ mile per hour per second), the preceding equation reduces to

$$F = 91.1$$

This means that an effort or pull of 91.1 lbs. is required for each ton of train weight for maintaining acceleration at the rate of one mile per hour per second.

Solving for W, we have

$$W = \frac{.01098\,F}{a} \qquad (23)$$

These three equations (21), (22), (23), give the value of each of the three quantities a, F and W, when the other two are known or assumed. They are the formulæ usually employed in discussing problems in train acceleration. The term F, it should be carefully noted, does not symbolize the total force applied to, or absorbed by, the train, but only that part of it which is expended in producing acceleration. It is one of the two factors of that portion of the total energy applied to the train which is really stored in the train in the form of kinetic energy of momentum; the other factor being (according to the fundamental formula of work, hereinabove,) the distance traversed while the force is operating. If the force remain constant in value throughout the entire distance, we have

$E = F\,s$, which is the same as equation (1).

If the force varies at different points, we have

$E = \int F\,ds$, which is the same as equation (2).

In any case where there are other forces besides that which is expended in, and represented by, the production of acceleration, these other forces may also be expressed in terms of acceleration, and using the letters F' F'' F''' to represent these forces, the total force P, would be:

$$P = F \pm F' \pm F'' \pm F''' \pm \text{etc.} \qquad (24)$$

the sign ($\pm$) being taken to mean that the forces in question may be either such as to produce acceleration, or such as to prevent it. The acceleration (a) which each of these forces would produce by itself, is to be determined by reference to equation (21a) same as the acceleration corresponding to stored energy.

Using the symbols a', a'', a''' to indicate these accelerations, and substituting their value, as given by equation (21a) in equation (24), we have

$$P = 91.1\,W\,a \pm 91.1\,W\,a' \pm 91.1\,W\,a'' \pm 91.1\,W\,a''' \pm \text{etc.} \qquad (25)$$

Since 91.1. W is common to all these terms, we may write this equation as follows:

$$P = 91.1\,W\,(a \pm a' \pm a'' \pm a''' \pm \text{etc.}) \qquad (25a)$$

From this equation we have

$$\frac{P}{91.1\,W} = a \pm a' \pm a'' \pm a''' \quad \text{etc.} \qquad (26)$$

But P being the total force, according to equation (25), and the quantity, 91.1 W, being the "converted" measure of mass, the quotient of these two quantities represents, according to equation (9) an acceleration which might be called the total acceleration. Using the symbol A' to designate this total acceleration, we have

$$A' = \frac{P}{W} = a \pm a' \pm a'' \pm a''' \pm \text{etc.} \qquad (27)$$

or the effective acceleration, in any concrete case, is equal to the algebraical sum of the accelerations which would be produced by each of the forces acting independently and alone.

This is a most important deduction which is of great utility and convenience in simplifying the analysis and the plotting of speed-time curves.

Equation (27) may be put in more practical form. The symbols "a" used in this equation in reality represent time-rate of acceleration, as is fully explained in Appendix A; consequently, each one is equal to a time-rate of velocity (dv / dt). The equation may, therefore, be written

$$A' = \frac{dv}{dt} = \frac{dv'}{dt} \pm \frac{dv''}{dt} \pm \frac{dv'''}{dt} \quad \text{etc.} \qquad (28)$$

The analytical statement of the deduction previously noted is, therefore, as follows:

The differential coefficient of an acceleration curve is equal to the algebraical sum of the individual differential coefficients corresponding to the various forces concerned and operating in producing the acceleration, each of these differential coefficients being determined separately, just as if it were alone concerned in the result.

Using the letter "k" (as is done in Appendix C), as a symbol to designate a time-rate of velocity, the above equation becomes:

$$A' = k \pm k' \pm k'' \quad \text{etc.} \qquad (29)$$

where k, k', k'', etc., represent the values of the differential coefficient, corresponding to the accelerations a, a', a'', etc., in equation (27). *(To be Continued.)*

Chicago's Mayor Will Veto All Traction Franchises

It is said that Mayor Harrison, of Chicago, has returned from his vacation apparently stronger in his purpose not to sign any traction franchise extension ordinance until the State Legislature gives the city the undisputed right to own the traction lines. It is even said that he will veto any proposition providing for municipal ownership as a possibility at the expiration of ten years. Mayor Harrison is quoted as saying:

"I will veto any such proposition unless the people vote for it at the coming election. I can't see why I should have to say again and again what I have said 100 times—that I shall not sign an ordinance until municipal ownership is made possible. If this question of franchise is not passed upon by the people this fall I shall oppose any Council measure that may be offered until there is legislation at Springfield by which we may attain municipal ownership."

An Outing of New York Street Railway Men

As is well known, President H. H. Vreeland, of the Interurban Street Railway Company, of New York, extends an invitation once a year to the heads of the departments of his company to visit his country home in Brewster, to participate in a clam bake and to have a generally good time among the attractive surroundings which Brewster enjoys. The fourth annual entertainment of this kind occurred Aug. 16. The guests were invited to meet at the Grand Central Station and go by special car, attached to the 9:09 a. m. train, via the Harlem Railroad, to Brewster. There is a large attendance, including practically all of the officers and staff of the Interurban Street Railway Company, as well as the following invited guests, among others:

F. S. Pearson, consulting engineer; Edw. A. Maher, president Union Railway Company; Thos. W. Olcott, secretary and treasurer, Union Railway Company; Henry Sanderson, president, New York Transportation Company; G. Tracy Rogers, president, Binghamton Railway Company and of the New York Street Railway Association; Hon. A. W. Cole, New York State Railroad Commissioner; W. W. Whcatly, of the Brooklyn Heights Railroad Company; A. M. Waitt, of the New York Central & Hudson River Railroad Company; W. F. Potter, of the Long Island Railroad Company; W. B. Yercance, of the Brooklyn Heights Railroad Company; G. W. West, of the New York, Ontario & Western Railway Company; D. M. Brady, of the Brady Brass Company; George G. Haven, Jr., and Pierre Jay, of the Second Avenue Railway Company.

Four carryalls met the train at the station, and the guests were at once driven to Lake Tonetta. The clam bake was held at the Tonetta Outing Club at high noon, at which time the guests collected from the various sports in which they amused themselves in the way of boating, fishing, ball, etc. "Two bells" were sounded and everybody was asked to "step lively" and partake of the luscious bivalves which composed the baking pyramid of clams. The day was perfect for an outing of this kind, and Mr. Vreeland's well-known hospitality was enjoyed by a larger number than ever before.

After an impromptu vaudeville performance, which followed the repast, the entire party was driven to Mr. Vreeland's summer home, Rest-A-While, where all the guests were received by Mrs. Vreeland. The house and its extensive grounds gave ample opportunity for a most enjoyable time, and the ping-pong tables, pool table, croquet and other outdoor sports proved very attractive, and a number of exciting games were soon in progress. In these athletic exercises many of the guests displayed a skill which was a revelation to most of their associates, who were acquainted with their intimate knowledge of street railway conditions, but who did not know that they were experts in other branches of study.

After a band concert in the evening the guests reluctantly took their departure, after one of the most enjoyable occasions in which they had ever participated, and all, except those who reside in Brewster, were whirled by special train on the Harlem Division of the New York Central Railroad back to the city.

The John Fritz Medal

The treasurer of the John Fritz medal fund, to which reference has been made in this paper, reports that enough subscriptions have been received to insure the success of the plan, but that a little more money would be desirable, and it has been decided to keep the subscription lists open for a short time longer, to enable any others who have not as yet sent in their subscriptions to do so. This medal, it will be remembered, is being founded to celebrate the eightieth birthday of John Fritz, the well-known engineer, and it was decided by the committee organized to institute the medal, to limit all subscriptions to $10, no more and no less, and to award the medal every year "to the originator of the most useful scientific or industrial achievements, in perpetual honor of John Fritz and to the glory of engineering." The medal is to be awarded by a perpetual committee of sixteen, to be appointed or chosen in equal numbers from the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the American Institute of Electrical Engineers.

The public celebration of Mr. Fritz's eightieth birthday and the foundation of this memorial will be held in New York City, Oct. 31. It will take the form of a dinner, in which the subscribers to the fund will have the first opportunity to participate. Further information can be obtained by those who desire it from John Thompson, treasurer, 253 Broadway, New York; or T. C. Martin, member of the committee for the American Institute of Electrical Engineers, 114 Liberty Street, New York.

CORRESPONDENCE

Brick for Car House Floors

New York, N. Y., Aug. 20, 1902.

Editors Street Railway Journal:

I have noticed a number of articles in your valued paper on the subject of car house construction, but have never seen any particular discussion in your columns as to the relative advantages of different materials to be used for flooring. Of course, in the old style car house and in the cheaper car houses of to-day, wood is the ordinary material used for this purpose. It is inexpensive but possesses so many manifest disadvantages, including that of inflammability, that I do not think that its use can be defended in any case except where first cost is the prime consideration with a railway company.

In the more modern car houses, so far as I have been able to learn, concrete is considered the most desirable material, and it is used almost exclusively for this purpose. Concrete is no doubt an ideal material in many ways, and it does not have many of the disadvantages which are possessed by a wooden flooring. Its appearance also is very attractive at first, but this statement cannot be made even after a few months of use. The concrete very soon becomes badly spotted by the oil and grease from the cars, and there does not seem to be any way of removing these stains.

The ideal material, it seems to me, for a flooring of this kind is a porous brick, which ought not to be any more expensive than concrete, if as costly, which dries quickly and which would not show oil stains. I understand that some of the railway companies abroad are using a brick of this kind which does not show oil spots. Whether this is so or not the ordinary red brick would be fairly satisfactory, I think, in this respect, as the discoloration would not be so conspicuous on it as on the lighter colored concrete. Moreover, brick would have the added advantages that it dries quickly, that it will not chip or crack so readily as concrete, and that any portion of the surface which does become worn can easily be renewed. I am not interested in any brick yard and offer this suggestion for what it is worth.

R. P. Gorman

The Training of Motormen

Wilkinsburg, Pa., Aug. 17, 1902.

Editors Street Railway Journal:

The prediction recently made by Mr. Edison that thirty years hence electricity will likely have replaced all steam locomotives, again impresses on my mind that railway managers who are at present converting their motor power from steam to electricity, are making a mistake in not requiring "motormen" to become equally familiar with electricity and the electric motor as they were with the steam locomotive, before being considered competent to handle same.

The experience or knowledge necessary to handle a trolley car can hardly be compared to that required of motormen in charge of a train of five or six cars, which the elevated railway systems operate.

I have had personal experience, in several instances, where lengthy delays to traffic and considerable damage to the apparatus could have been wholly avoided by the motorman or conductor, if they had even a crude knowledge of electricity.

Their instructions or requirements in most cases do not go beyond a knowledge of the movement of controller handles, and as some men are not very ambitious their knowledge does not increase, since their officers do not insist on it. In my mind, it would add greatly to the success of electricity in heavy traction work if motormen were expected to pass an examination, which would compare favorably to the standard required of locomotive engineers. The steam engineer that would permit the crown sheet of the fire-box to burn because the water supply ran out, would surely be considered incompetent. But in many cases, recently, motormen have been guilty of equally absurd failures to protect the balance of the apparatus when one part became inoperative.

M. B. Lambert.

The Doylestown Electric Company, of Doylestown, Pa., has recently contracted with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, for two kilowatt engine-type 2-phase alternators, with direct-connected exciters, complete with switchboard. The engineer for the work is Dr. W. A. Drysdale, of Philadelphia.

The Efforts of an Independent Company to Secure Entrance to Trenton, N. J.

The New Jersey & Pennsylvania Traction Company has asked the Common Council of Trenton, N. J., for franchises on Willow, West Hanover and Calhoun Streets, as well as through a part of the old city reservoir property. The company proposes extending its Princeton line from the present terminus, at Ingham Street, to the center of the city, a distance of one mile, and the Yardley line from the Upper Delaware Bridge to the center of the city. The Princeton line is now operated under a steam charter from its present terminus to the borough line of Princeton, but the Trenton, Lawrenceville & Princeton Railroad, as it is officially known, will terminate at the Trenton city line. The extensions will be constructed under the New Jersey & Pennsylvania Traction Company's charter. For 500 yards the road will run on private right of way, crossing several streets at grade, and entering Willow Street at its northern terminus. In order to reach Willow Street it is necessary to pass through a part of the old reservoir property (the new reservoir being a half mile away), and the company is seeking to purchase this from the city. The company offers to give the city, in return for the franchise, about $50,000 in property; also to do considerable street paving. The company has agreed to deed to the city a part of the valuable property at West State Street and Calhoun Street, just west of the State Capital, for which the company paid $45,000; also to deed other lands of the company in order that Calhoun Street may be made from 10 ft. to 15 ft. wider than at present. Wherever there is paving upon any street (Willow Street and West Hanover Street are paved with vitrified brick) the company agrees to pay for such portion as its tracks may occupy, between the same, and for a distance of 1 ft. upon each side. This money the company has agreed to pay as may be determined by a committee, appointed for that and other purposes in connection therewith by the Common Council. In addition it is agreed that the fares shall not be more than 3 cents within the city limits, with free transfers to the company's own and such other lines as may enter into traffic relations with it. Two cents extra will secure a transfer to Lawrenceville, 6 miles out; 2 cents extra to Morrisville, Pa., across the Delaware, and 7 cents extra to Princeton, which will be 13 miles from the center of Trenton, when the extensions are built. High-grade equipment is promised, and the minimum wages to be paid motormen and conductors will be 20 cents per hour.

No action was taken by Common Council at the meeting at which the petition and ordinance were presented, but President Hill was authorized to appoint a committee to investigate as to what could be done with the old reservoir property, and also to ascertain what the chances would be for damage to the city's water mains, which run through Calhoun Street. This committee will soon be appointed. As a whole the citizens of the city seem to be in favor of granting the franchise without loss of time, but there is a movement on foot among some of the city officials to ask the company to give to the city the Calhoun Street Bridge across the Delaware River in addition to the concessions it has offered. The company paid more than $200,000 for this bridge, which is about 1100 ft. long, and collects tolls (as has always been done) for teams and pedestrians. Under the present offer of the company the city will receive about $27,000 per mile for the franchises, and to give the bridge, too, would make the franchises cost the company about $127,000 per mile. Another drawback to deeding the bridge to the city, aside from the amount of money involved, would be that it would afford other companies the right to cross, by permission of the city. This bridge was purchased by the New Jersey & Pennsylvania Traction Company for a figure which was considered prohibitive by all the other companies that had sought its purchase, and the demands that it be deeded to the city certainly is very unreasonable.

A peculiar situation is now presented by this latest move of the New Jersey & Pennsylvania Traction Company. Up to Dec., 1901, no foreign company had ever asked permission to enter the city, and previous to April, 1901, no other company had reached the city line. In Dec., 1901, the Camden & Trenton Railway Company asked for a number of franchises to bring its line from Camden into this city, and they were speedily granted, but they are yet tied up in the State Courts, through action brought by the Trenton Street Railway Company to prevent the company from entering the city. The Yardley, Morrisville & Trenton Street Railway, now owned by the New Jersey & Pennsylvania Traction Company, came into the city limits last August, but it was upon the Calhoun Street Bridge, and no franchises were necessary. The New Jersey & Pennsylvania Traction Company now seeks permission to bring two lines in, from the west and north. The Trenton & New Brunswick Railroad, nearly completed under a steam charter, touches the city line on the east, and will doubtless soon be asking admission under a traction charter, and the Delaware Valley Traction Company, incorporated last fall, has maps filed covering every available outlet from the city except those already covered. This company is also securing rights of way for several of the routes.

There is so much public feeling concerning the franchises of the New Jersey & Pennsylvania Traction Company, as well as the other new roads, that an effort is said to be on foot among the city officials to stave off action until after the fall elections, but this will be difficult. It is quite possible that Trenton may be treated to scenes such as have been witnessed in Cleveland, where efforts have been made to secure a low-fare franchise by an independent company. Mayor Katzenbach, of Trenton, is counsel for the New Jersey & Pennsylvania Traction Company, and the company is controlled by the Johnson syndicate. The Mayor is a Democrat, but the Council is Republican.

The New Jersey & Pennsylvania Traction Company now transfers its passengers from the Ingham Street terminus of the Princeton line to the center of the city by means of 'buses, which are a great expense and cause considerable delay. The passengers from the Yardley line have to use the local road or walk. The Princeton line has been put in such fine shape for the entire 12 miles from the Trenton city line to the Princeton borough line that a car can be run at full speed the entire distance, not a single slow-down being necessary.

The Aldermanic Investigation of New York and Boston

An account was given, in a recent issue, of the trip of the committee on local transportation of the Chicago City Council to New York and Boston to investigate the subways in those cities, and other subjects connected with rapid transit facilities. The Aldermen, who were accompanied by Alderman Frank I. Bennett, chairman of the committee, and Bion J. Arnold, electrical expert, spent two days in Boston after leaving New York, and then returned to Chicago. Interviews with a number of the gentlemen composing the committee indicate that the investigation carried out by them was very successful in the direction of securing information sought. The question of a subway, which was one of the principal objects of the trip, received especial attention, and the members seemed unanimous in their opinion of the desirability of a subway for Chicago. An abstract of some of the interviews published in the Chicago papers with different members of the committee follows:

M. J. Foreman stated that the investigation, in his judgment, demonstrates "that no arrangement or duplication of surface tracks, terminals, or routes can be devised for Chicago that will supply adequate and rapid street car service.

"That a system of subways for street cars, at least in the congested districts, is an essential if Chicago is to have good, comfortable and rapid transportation.

"That the best service is achieved where all passenger-carrying lines in a city, whether on the surface, in the air, or under ground, are operated by one company as one line or system.

"That if such consolidation cannot be had at once in Chicago at least co-ordination should be required of companies as one of the conditions for franchise extension."

The Boston subway, he believes, passes through substantially the character of places as would be found in Chicago, but that one difficulty which was encountered in Boston, that is, sudden and steep changes of grade, would be unknown in the former city. The Brooklyn condition, Mr. Foreman continues, "resembles ours in a great many ways. The traction companies carry their passengers a long distance, several miles from the center. Relief there must be secured from a system of subways which should connect or be part of the New York subway and thereby bring passengers from any point in New York to any point in Brooklyn. New York or Brooklyn present conditions that Chicago cannot have or improve upon."

Frank I. Bennett refers to the immense traffic in New York, and while he acknowledges that the New York problem of transportation is probably the most difficult in the world, refers to its rapid and comfortable transportation service, which apparently gives satisfaction to the public. "The system of transfers," he says, "is a little puzzling to the stranger, but enables the citizen who is posted to reach any part of the island without an additional fare. The companies, in short, reserve the right to route the passenger in order, it is claimed, to prevent the congestion of all traffic on any one main line, and thereby render service unsatisfactory, and, owing to the conditions, I am not prepared to say that this regulation is not the best here."

Mr. Bennett says the service in Boston is almost ideal, and refers particularly to the subway and the new subway under the Boston Bay. He concludes, "the city officials and railway men of New York, Brooklyn and Boston have afforded the committee every facility, and have shown us every courtesy, and the com-

mittee on local transportation will return to Chicago with a fund of information gathered from personal observation which will enable it to recommend a system not only equal, but superior, to the best in these places."

W. J. Raymer says: "My judgment is that consolidation of the street railways in both Boston and New York has resulted in giving the people many advantages not obtainable in the operation of separate companies. Chicago can have an ideal service by the construction of a subway, and the new franchises should provide for this improvement. There are a number of features of a minor nature which Chicago should benefit from which would be provided for by the city controlling the street car situation as the city of Boston does."

William Mavor says: "The fact that one company operates all the lines, surface and elevated, in Boston, gives that city the best transportation system and the people the most complete service in the country. In New York all the surface lines are operated by one company, so that New York, having unification of service to that extent, is also much better prepared to give its people good service."

New York State Electrical Laboratory Commission

An outline of the proposed establishment in New York State of a State Electrical Laboratory Commission has already been noticed in these columns. The bill appointing these commissioners was passed at the recent session of the State Legislature, and defined the purpose of the Commission as follows:

For investigating as to the necessity for the establishment of a State Electrical Laboratory to provide independent, authoritative information on questions of electrical scinece, and an official standardizing laboratory for electrical measuring instruments, apparatus and standards for the protection of municipalities and the general public in the use of electrical energy and of the producers of electrical energy. Said commission is hereby directed to report to the Legislature at the opening of the session of 1903, and if, in their judgment the establishment of said electrical laboratory is necessary, to prepare and submit in connection with their report, detailed plans and specifications for the construction and equipment of such laboratory, accompanying said plans with a specific and detailed statement of the cost thereof.

Under this law a commission consisting of three members, viz.: Edward A. Bond, of Albany, chairman; Charles P. Steinmetz, of Schenectady, and Harold W. Buck, of Niagara Falls, has been appointed.

In the establishment of a New York State Electrical Laboratory (which could serve as a precedent for similar institutions in other States) it is proposed to organize an institution of the highest efficiency and widest scope, which shall be capable of dealing in an authoritative manner with all problems which may arise in the mutual interests of the people of the State; to have its equipment such that all phenomena in question can be reproduced on a large scale and results under various conditions demonstrated; to have a complete set of standards for the calibration of all types of electrical meters; to have an electrochemical laboratory for demonstrations and analysis; to have the location of the institution such as to be central in the State and near to some large source of power from which several thousand horse-power can be drawn at times for experimental purposes by a special transmission line; and, last, to have the institution presided over by a man of high standing and ability, assisted by a corps of competent assistants, who can carry out the work which will be called for by the people of the State, for merely its cost.

It is not the intention to have this State laboratory conflict with the Natural Bureau of Electrical Standards at Washington, but to have it co-operate with it and attend only to such local matters in the State which can more properly and conveniently be handled within the limits of the State.

An idea of the importance and extent of the interests involved can be obtained from the following statement of the capitalization of corporations in New York State engaged in business involving the use of electricity:

(*a*) Electric railroads, electric light and power stations, telegraph and telephone companies	$1,462,615,595
(*b*) Companies engaged in the manufacture of electrical apparatus	217,974,695
Total	$1,680,590,290

In the present status of the distribution of electrical energy disputes arise, among other causes, from the following:

1) From mutual induction, static or magnetic, between independent circuits, especially between circuits carrying large currents or high potentials and circuits used for the transmission of intelligence, such as telephone, telegraph, fire alarm, railway block signals, etc.

(2) Accidents to life resulting from conditions frequently not clearly understood at the time of accident, such as crossing of circuits, failure of insulation, etc.; also from insufficient warning notices on circuits of dangerous potential.

(3) Between producers of electrical energy and public consumers, such as municipalities in street lighting contracts, involving the quantity of light supplied, the trouble arising from lack of officially standardized photometric methods.

(4) Between producers of electrical energy and public and private consumers on the quantity of current or energy supplied, resulting from inaccuracy of meters or methods of measurement.

(5) From electrolysis in railway and other grounded systems.

(6) From risk and damage to property from fire caused by defective insulation of circuits.

(7) Between producers and consumers of electrical energy and fire insurance underwriters on methods of installation.

(8) Between independent interests having adjacent distributing circuits under ground from damage caused by heat in short circuits in conduits and subways.

(9) From damage caused by explosions in subways and conduits.

10) Between manufacturers of electrical apparatus and purchasers on guarantees for electrical performance.

(11) Between producers of electrical energy and municipalities on the subject of transmission voltage of overhead circuits.

(12) Between the producers of electrical energy and the general public in cases of rights of way for very high voltage transmission lines where danger to life and property is claimed.

(13) Between the general public and manufacturers of electrochemical products where destructive fumes and gases are claimed to be set free in the process of manufacture.

(14) Many other cases which will undoubtedly arise as the art advances, such as interference in wireless messages.

At present all such disputes, when brought to issue, are settled by the courts, the decisions being based largely upon expert testimony given by those who may or may not state with accuracy the facts involved. For such expert testimony large fees are required, which add greatly to the cost of settlement, and this obtains even in cases of the most simple and obvious decision. No authority exists which can be recognized by the courts as official, nor any institution where the points involved in such disputes could in many cases be made the subjects of actual demonstration by experiment.

The commissioners, whose names are given above, are now, under the authority of the act quoted, engaged in organizing the department, and have issued a general invitation to all interested for their opinion upon the proposed institution, as to its scope, organization, equipment or location. Communications can be addressed to the State Electrical Laboratory Commission, State Engineer's office, Albany, N. Y., or personally by letter or interview with one of the commissioners.

Converting Steam Road to Electric System

The Tennis Company, of Cincinnati, has undertaken the work of converting the Cincinnati, Georgetown & Portsmouth Railway into an electric system. This road is at present a narrow gage steam railway, and has been operated as such for about twenty years, and extends from Carrel Street, Cincinnati, where it connects with the Pennsylvania Railroad Company, to Georgetown, the county seat of Brown County, a distance of 42 miles, including a branch of about 1 mile from a point near Cincinnati to California, where the new city water works are being constructed. This branch line has recently been extended to Coney Island, a distance of about 1½ miles, and in connection with that part of the main line, between the junction point and Carrel Street, has been electrified and is now being operated as an electric railway by means of an extra rail laid, so that one of the narrow gage rails and this extra rail constitutes the track for the electric cars.

The power house is located at Olive Branch, a point 15 miles from Carrel Street, and is being equipped with six 250-hp Cahall boilers, two 600-kw Westinghouse alternating generators, direct-connected to two 915-hp Hamilton-Corliss engines. The plant will be compound condensing. Three sub-stations will be located on the line in addition to one at the main power station. The road has been and will continue to do freight as well as passenger business, operating when completed as a standard gage electric line instead of a narrow gage steam line.

The main line will be equipped with ten 50-ft. passenger cars in addition to those operated on the Coney Island line, which are 40 ft. in length. The latter cars will run direct to the center of Cincinnati over the Cincinnati Traction Company's line. The company has also decided to build several branches.

Financial Report of the Glasgow Corporation Tramways

The report for the year ending May 31, 1902, of the Glasgow Tramways, the largest municipal tramway system in Great Britain, is meeting with considerable adverse comment in that country, and it is claimed that the results secured are not so successful as some of the advocates of municipal enterprise would have the public believe. The Glasgow Herald, for example, states that while the report apparently shows a large profit for the enterprise, these "profits," if analyzed, will be found entirely imaginary. The reasoning upon which this deduction is based follows:

The revenue for the year ending May 31 last, according to the accounts, was £614,413 4s. 11d., the working expenses were £405,103 0s. 7d., and the "gross balance" is £209,310 4s. 4d. This is the first year of operation entirely by electric traction, or practically so, for only £30,680 was earned by the few horse cars kept running, and the working expenses of the horse traction were £754 in excess of the receipts. In the year ending May 31, 1901, the revenue from both horse and electric traction was £489,469 8s. 7d., the working expenses were £401,839 14s. 8d., and the "gross balance" was £87,629 13s. 11d. From this year's "gross balance" certain deductions are made in the report, viz.: £5057 3s. 10d. for the use of the Govan tramways, £54,282 17s. 10d. for interest, £36,974 15s. 9d. for sinking fund, and £12,500 for payment to the Common Good by way of street rental. When these deductions are made there remains a sum of £100,495 6s. 11d., which is transferred to the General Reserve Fund, and which, therefore, the public will believe to be net profit. It is nothing of the sort, as shall presently be shown.

The payment to the Commissioners of Govan of £5057 is for the use of 4¼ miles of track, equal to £1,1190 per mile, while that to the Common Good for the use of 41 miles of street within the municipal boundaries is only £12,500, or £300 per mile. If the same rate had been paid for this track as in Govan, and this would have been required of a private corporation, the amount would have been £48,790 instead of £12,500. Accepting, however, the report as it is, we will take up the General Reserve Fund, which, the criticism of the report claims, has been applied in liquidation of payments that ought to have appeared in the general balance sheet. The General Reserve Fund at May 31, 1901, stood at £183,428 6s. 10d., and, augmented by the transfer of the above £100,495 6s. 11d., it would be £283,923 13s. 9d But, first of all, from it is taken £190,000 to transfer to Permanent Way Renewal Fund, from which the expenditure during the past three years has been £240,560 2s. 5d., and in which a balance now remains of only £85,344. In the report it is stated that this sum is all that is considered necessary by way of provision for the renewal of the track. But it is doubtful whether, in view of the heavy double-deck cars used in Glasgow and the large amount of special work, an expenditure of £450 per mile of single track per annum will be sufficient for upkeep. To come back to the Reserve Fund, however. After allocation of the £190,000 for payment of part renewals of the track, there was nominally at the credit of the fund a sum of £93,923 13s. 9d. But this is only a book entry for depreciation—cost of alteration of buildings to suit electric traction, the loss on last dispersal sales of horses, and so forth, are taken out of this fund instead of out of the reputed "gross balance." These debits absorb £93,539 15s. 9d. and leave only £383 18s. at the credit of the General Reserve Fund. A recast of the balance sheet without the cross-entries through Reserve account would then read as follows:

RECEIPTS		
Gross per statement	£614,413 4 11	
Less working expenses	405,103 0 7	
		£209,310 4 4
EXPENDITURE		
Govan Tramways	£5,057 3 10	
Interest on capital	54,282 17 10	
Sinking fund	36,974 15 9	
Common Good	12,500 0 0	
Depreciation, &c., per reserve fund account	93,539 15 9	
		202,354 13 2
Net balance		£6,955 11 2

Instead, therefore, of a profit of £200,000 from the tramways, there is less than £7000 out of which shareholders could have got any dividend after payment of debenture charges. Had the Department to pay rental, such as a company would have to do, instead of a trifle of £12,500 to the Common Good, there would have been a dead loss of over £40,000. This is assuming that enough has been written off for depreciation in every direction, which, however, is assuming too much. The track depreciation has already been referred to. The depreciation written off for cars is £22,541 on a total value of £296,355, while that on electric equipment is £14,690 on a total capital outlay of £466,596, both manifestly too small. This showing is in face of the fact that no private corporation could raise money on bonds or debentures as cheaply as the Tramways Department can borrow of the City and there is no Board of Directors to pay, whose services would perhaps be more valuable than those of an unpaid, however zealous, committee of the Town Council, but whose fees, at any rate, should be placed in the balance when weighing the comparative advantages of private and municipal enterprise. In conclusion, the Herald states that the citizens of Glasgow must disabuse their minds of the idea that the corporation tramways are a highly remunerative undertaking.

New Franchise in Kansas City

The new franchise ordinance of the Metropolitan Street Railway Company, of Kansas City, Mo., passed by the City Council on July 25, has been signed by the Mayor, and its acceptance by the company has been filed with the city authorities. The ordinance provides that the company and its subsidary organizations shall, beginning June 1, 1902, and so long as they operate under existing franchises, set aside each year 8 per cent of the gross car and track earnings, and, having paid therefrom all State, county and city, school and municipal taxes and licenses, shall turn over any balance of said 8 per cent to the city. This provision, it is believed in Kansas City, will increase immediately the amount to be paid to the city by $100,000 yearly. For the concessions of the company the city grants franchises covering substantially all of the city not now covered by the street railway company. The company agrees to equip with electricity its remaining cable lines and to make various specified extension within a given time. Provision is also made for universal transfers, but there is a clause which provides against "looping" transfers.

Changes in Dick, Kerr & Co., Ltd., of London

According to late English advices, Dick, Kerr & Co., of London, who have for some time been sole selling agents for and large shareholders in the English Electric Manufacturing Company, Ltd., of Preston, have now taken over the whole of the shares of that concern. The business of Dick, Kerr & Co. has been conducted as a private limited company so far, its shares being held almost entirely by members of the firm. The amalgamation has been effected by Messrs. Dick, Kerr & Co. exchanging £100,000 ordinary shares for the £200,000 in the English Electric Manufacturing Company, and they have exchanged £145,000 out of the £185,000 preference shares in the latter company. The debentures have not yet been dealt with, but it is intended to convert the Dick, Kerr & Co. 4 per cent debentures to 4½ per cent, the same as those of the other company, and to raise the preference dividend to 6 per cent all round. The capital of Dick, Kerr & Co. now figures at £840,000, and its profits for the last three years have averaged over £60,000, which is sufficient to pay the increased interest on the preference stock and debentures in the two concerns, and also give a 10 per cent dividend on the ordinary. For the current financial year the profits are estimated to be considerably in excess of previous years. The English Electric Manufacturing Company has also been earning substantial profits. It is stated that during the last eighteen months these have been £67,000.

Kincaid, Waller, Manville & Dawson

The announcement has just been made that Mr. Philip Dawson, the well-known British electric traction engineer, has joined the old-established firm of Messrs. Kincaid, Waller & Manville, consulting engineers. The new title of this firm will be Kincaid, Waller, Manville & Dawson, their address being as before, 29 Great George Street, Westminster. Mr. Manville, one of the members of the firm, is almost as well known in America as he is in England, having been connected with several electrical undertakings, among which we may mention the Massena Power Transmission in New York State, and the Buenos Ayres Tramways in South America, which was recently described in our columns. Mr. Dawson has also made several visits to America, and has made a special study of American methods. He is also widely known as a writer on technical subjects and as the editor of "Dawson's Engineering and Electric Traction Pocket Book." He will bring to the company a ripe experience in traction matters and power transmission, of which two particular branches of the electrical profession he has made a special study.

The Improved Automotoneer

The advantages of the proper manipulation of the controller handle in starting so as to prevent the enormous waste of power in the rheostats have been admitted for a long time, and a number of devices have been introduced to compel the motorman to move his handle at the proper speed only. Among them the one which is probably best known is the "Automotoneer," which was invented by George M. Knox, fomerly of the Chicago City Railway Company, and is now offered in a perfected form by the Garton-Daniels Company, of Keokuk, Ia. In the development of this device the Garton-Daniels Company has spent the past three years bringing out, at a great expense, several models, that, while they would do the work, were not all that could be desired from an operating standpoint. The present model, however, has been in use in different parts of the country for the past seven months, and the manufacturers state that there is yet to be received a single complaint about it.

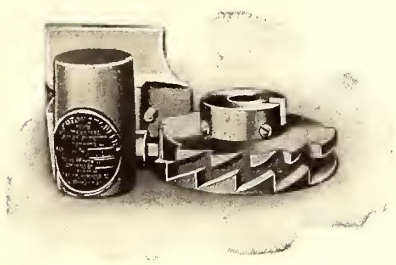


FIG. 1.—WHEEL AND REGULATOR

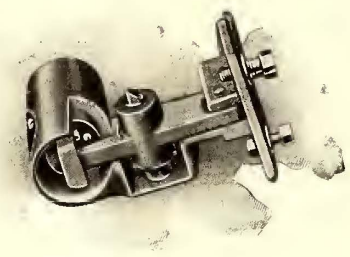


FIG 2.—BOTTOM VIEW OF REGULATOR

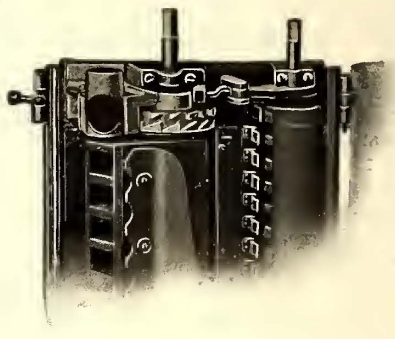


FIG. 3.—DEVICE APPLIED TO CONTROLLER

The device consists of the wheel and regulator shown in Fig. 1. The wheel has a zig-zag groove in its periphery, as shown, with suitable ratchet teeth for engaging the dog of the regulator, which rides in the grooves as shown. The regulator consists of the dog, or pawl, mounted on a pivoted lever, which is fastened to the back of the controller casting. The outer end of this lever engages a piston working in the cylinder of the dash-pot. This piston has a long bearing surface, and is provided with an adjusting-valve to regulate its movement, as well as a release-valve to permit easy operation.

When the controller is operated, the wheel, being attached to the shaft in place of the usual star wheel, rotates, and the inclined surface of the slot raises the pawl and lever which in turn raises the piston in the dash-pot. The pawl then strikes the ratchet stops which are far enough back of the vertical portions to allow the pawl to drop when the pressure is relieved upon the controller handle, to the bottom of the groove, so that the upper edge of the pawl clears the bottom of the ratchet stops, when another notch may be taken. The adjustment of the piston-valve determines the speed of the pawl in its downward movement, and regulates the operation of the controller.

The wear on the moving parts is reduced to a minimum. The piston has no strain on it, simply rising and falling in a vertical bearing. The pawl is case-hardened and shows practically no wear after continued use. It is held in the groove by a coiled spring, and its back edge beveled so that when the wheel is reversed, in order to throw off the current, the pawl slides back against the tension of the coil-spring, thus permitting a ready and sure return of the handle to the "off" position.

Fig. 2 shows a bottom view of the regulator, and it will be noted that the thrust against the pawl is taken up by the regulator casting, and does not bind or bring any strain on the dash-pot piston, which rides perfectly free on the outer end of the lever. The dash-pot is lubricated with dry powdered graphite only, and each device is sufficiently lubricated when sent out for at least one year's service.

In action the automotoneer requires the motorman to stop on each point of the controller for a predetermined time. This time element may be adjusted so that it is impossible to turn on the full power in less than five seconds, seven seconds, ten seconds, or as desired.

The ideal acceleration is as rapid as can be attained without the slipping of the car wheels, and considering this feature it has been found that on an average track a ten-second start is ideal.

Taking this as a basis and a four-second start as the average method employed by a careless motorman, it has been estimated that a saving of about 45 per cent of the power used in starting or 20 per cent of the total power can be secured on a line making many starts and stops. The correct and economical application of the current to the motor car not only works a large saving in the expense of the power but also lengthens the life of the motor in proportion to the reduction of the amount of work required of them, which in the course of a year will result in a large saving for motor repairs. The proper amount of current will reduce the risk of personal injury by the sudden starting and jerking of the car.

Fig. 3 shows a standard G.-E. type K-10 controller fitted with the automotoneer. The device is entirely concealed when the controller is closed. The same device may be used on types K-2, K-4, K-5, K-7, K-8, K-9, K-10, K-11 and K-12 controllers. Other types now being perfected.

Employees' Rooms at Rochester

The new quarters of the employees of the Rochester Railway Company were formally presented to the men on the afternoon of Aug. 4. In the evening there was an entertainment, attended by some 350 of the men and their families, and addresses were made by Rev. J. Lyon Caughey, Vice-President and General Manager T. J. Nicholl, of the company; Assistant Manager R. E. Danforth, of the company; John F. Dinkey, auditor and treasurer of the Buffalo, Rochester & Pittsburgh Railroad; J. M. Dudley, who is in charge of the association rooms of the employees of the Brooklyn Rapid Transit; William C. Montignani, who will supervise the work in Rochester, and several others. As in Brooklyn, the local branch of the Young Men's Christian Association has become interested in the work of the street railway men, but it is not necessary to become a member of the Young Men's Christian Association in order to enjoy the advantages of the rooms. Additional privileges, however, are gained by becoming a member of the Young Men's Christian Association. Every convenience that is provided in the well-appointed club is to be had by the employees at their rooms. A three-months membership ticket was presented to all employees of the company. Mr. Montignani, who will have charge in Rochester, came from Montreal, where he was secretary of the Young Men's Christian Association railroad branch of the Grand Trunk system.

More Injunctions at Cleveland

The Supreme Court tied up the City Council of Cleveland on Aug. 15 by granting an injunction asked for by the attorneys of the Cleveland City Railway Company and the Cleveland Electric Railway Company.

The Council was some time ago about to pass a 3-cent fare franchise ordinance when an injunction stopped it. The Circuit Court dissolved the injunction, but the opposition carried it to the Supreme Court, and that body has continued the injunction until a full hearing can be given the matter. If the Supreme Court sees fit it can hold the case until next spring. This means that 3-cent fare in Cleveland is blocked, perhaps for a long time, as the Legislature in special session may remove franchise-granting powers from the present Council.

Progress on the Levis County Railway

The Levis County Railway Company, Levis, Can., has appointed the Morris Electric Company purchasing agent for all of its American supplies. Levis is a small town directly across the St. Lawrence River from Quebec, and the railway is the beginning of what promises to be an important system. The general manager of the Levis County Railway Company is G. U. G. Holman. Work has been carried on rapidly on the new system and inclined railway which will be operated in connection with it, and the line will probably be opened within a few weeks.

An Offer of Bonds

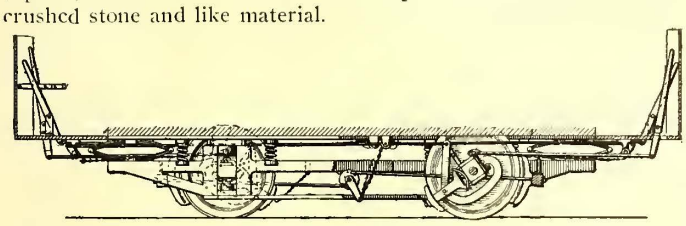
The United States Mortgage & Trust Company, of New York, is offering for sale an issue of $1,000,000 4 per cent 5-20 year first mortgage trust gold bonds. These bonds are specifically secured by a deposit with the Guaranty Trust Company, of New York, of $1,000,000 of first mortgages on improved real estate in the principal cities of the United States, valued at $2,648,969, having a gross income of $265,273, and a net income of $178,372, as against the 4 per cent charge on the above bonds of $40,000. In addition to this security these bonds, together with the company's deposits, are a direct obligation against all of the company's assets, amounting to over $32,000,000. The care with which the company's mortgage investments have been made is evidenced by the record of the past seven years, during which over $13,000,000 have been invested, and no real estate is now owned by the company.

Street Railway Patents

UNITED STATES PATENTS ISSUED AUG. 12, 1902.

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beckman Building, New York.]

706,619. Beam for Railroad Track Foundations; L. B. West, Cincinnati, Ohio. App. filed Dec. 14, 1901. A longitudinal track beam surrounding the sides and bottom of a rail and composed of asphalt, coal-tar or other bituminous products mixed with sand, crushed stone and like material.



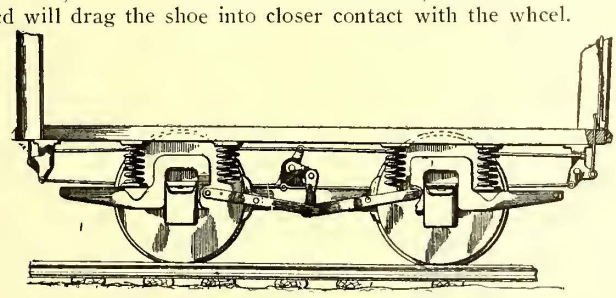
PATENT NO. 706,672

706,668. Switch Throwing Device; T. J. Kent, Pittsburgh, Pa. App. filed March 4, 1902. Details of a switch mechanism operatable from the platform of a moving car.

706,672. Car Brake; R. E. Lockwood, Chicago, Ill. App. filed April 3, 1902. A friction mechanism which may be brought into contact with the periphery of the car wheel, sets the brake-shoe.

706,815. Hose Bridge; G. H. Frazier, J. W. Wagner and H. G. Iserberg, Dennison, Ohio. App. filed March 3, 1902. Details of an arc-shaped structure to be applied to car tracks, with an opening for the passage of fire hose.

706,824. Brake for Vehicles; W. F. Hitchcock, Rochester, N. Y. App. filed March 10, 1900. A brake mechanism in which the brake-shoe has an arc of movement eccentric to the circle of the rim of the wheel, so that the friction of the wheel when the brake is applied will drag the shoe into closer contact with the wheel.



PATENT NO. 706,824

706,950. Railway Switch; C. Johnston, Memphis, Tenn. App. filed Jan. 9, 1902. A fender operated by a foot lever and adapted when operated to cause a discharge of sand to the track, so that the application of the brakes will be more effective.

706,950. Railway Switch; C. Johnston, Memphis, Tenn. App. filed May 3, 1902. Details of a switch adapted to be operated from the front end of a car.

707,018. Convertible Car; H. Romunder, Newark, N. J. App. filed April 12, 1901. The car body is a metal skeleton frame which is provided with grooves for sliding sections, which may be raised and lowered.

PERSONAL MENTION

MR. J. Z. GEORGE has tendered his resignation as manager and purchasing agent of the Vicksburg Railroad, Power & Manufacturing Company, of Vicksburg, Miss. Mr. George has not announced his plans for the future.

MR. M. E. SATCHWELL has resigned as superintendent of the Main Street Railway and the Jacksonville Street Railway Company, of Jacksonville, Fla., and Mr. William Henry Tucker, connected with Stone & Webster, of Boston, has been appointed as successor to Mr. Satchwell.

MR. J. P. POTTER, formerly superintendent of the western division of the Oakland Transit Company, of Oakland, Cal., has been appointed superintendent of the entire system of the company. Mr. Potter has been connected with the street railways of Oakland since the cars were first placed in operation.

MR. F. J. GREEN, general manager of the Dayton, Springfield & Urbana Electric Railway, of Springfield, Ohio, has been succeeded by Richard Emery, who will be general manager of all the Appleyard syndicate properties radiating from Columbus. Mr. Green will take charge of the construction work for the syndicate.

MR. O. E. OLESON, chief engineer of the power house of the Toledo Traction Company, of Toledo, Ohio., who recently resigned from that company to accept a position with the Twin City Rapid Transit Company, of Minneapolis, was presented with a fine diamond Elks ring by employees of the company a few days ago. Mr. W. L. Long succeeds Mr. Oleson at Toledo.

MR. J. W. DUGGAN has been appointed to the position of superintendent of rolling stock of the Worcester & Webster Street Railway, the Webster & Dudley Street Railway, the Worcester & Connecticut Eastern Street Railway, and the People's Tramway Company, operating in Massachusetts and Connecticut. Mr. Duggan is a street railway man of seventeen years' experience, and formerly was superintendent of rolling stock of the Youngstown & Sharon Street Railway, of Youngstown, Ohio.

PROFESSOR GEORGE F. SEVER, adjunct professor of electrical engineering at Columbia University, has been appointed electrical engineer of the Department of Water Supply, Gas and Electricity of New York City. Professor Sever was last year superintendent of electrical exhibits at the Pan American Exposition, and combines a large amount of important outside work with his college duties. He is consulting engineer for Wendell & McDuffie, of New York, and has devoted considerable attention to the plans of the road which that well-known firm is constructing between Oneonta, Cooperstown and Richfield Springs, N. Y.

MR. CHARLES G. WINGATE, formerly superintendent of the Ridgewood Avenue Division of the Brooklyn Rapid Transit Company, has recently become connected with the New York office of the Crocker-Wheeler Company. Mr. Wingate, who is a son of General George W. Wingate, formerly vice-president of the Brooklyn Elevated Railroad Company, has had charge of the construction of a number of electric railways, including the Ocean Electric Railway and the Rockaway Electric Railway divisions of the Long Island Railway Company, and the Branford Electric Railway, which runs between East Haven and Branford, Conn., and which is now operated under lease by the Fair Haven & Westville Railroad Company.

MR. J. W. PERRY, who has for a long time represented the H. W. Johns-Manville Company in Philadelphia, has recently been appointed head of the electrical department of that company, and will hereafter make his headquarters in New York. Mr. Perry is well known in the electrical and street railway field, particularly in the Middle States, and has invented and patented a number of improvements in electrical work. He was one of the Americans who attended the convention of the International Tramway Association in London last July, and he took the opportunity while in Europe of making a short trip on the Continent, where the Johns-Manville Company has filled a considerable number of orders. Mr. Perry reported the outlook for business in Europe as excellent.

MR. F. A. BOWTELLE, chief dispatcher and acting train master of the Susquehanna Division of the Delaware & Hudson Company, has been appointed superintendent of the Hudson Valley Railway, of Warrensburg, N. Y. Mr. Bowtelle has been a railroad man for many years, and he is well qualified for the position to which he has just been appointed. Mr. Bowtelle was in the employ of the Delaware & Hudson Company almost constantly since 1870. In 1878, when the Delaware & Hudson Company was interested in the Boston, Hoosac Tunnel & Western Railway, Mr. Bowtelle was transferred by the company to the last mentioned road, filling acceptably the position of train master while the relation of the two companies continued. During the period extending from 1872 to 1875 Mr. Bowtelle filled an important position in the office of the president of the Baltimore & Ohio Railway. Until a few years ago the Susquehanna Division was a single-track line of 196 miles on which one hundred engines and thousands of cars were operated with remarkable freedom from accident.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

Wall Street, Aug. 20, 1902.

Money rates, as had been fully expected, have worked decidedly closer during the week. The average rate for call loans has been 4½ per cent, with occasional advances to 6 per cent. Time loans, meanwhile, have been marked up to a stiff 5 per cent for all dates. The causes for this upward movement have lain on the surface for several weeks past, and ought not to need rehearsal in this column. With the large gold exports at the outset of the month and the steady expansion of loans, surplus reserves of the Clearing House banks have sunk rapidly, until they now stand at the scant total of $7,100,000. This, with one exception, is the lowest for any corresponding period in the last ten years. To all appearances out-of-town banks, which have been lending directly in the New York market, withdrew their funds in anticipation of the active autumn demand in their own localities. It is also quite likely that local trust companies did the same, with the idea of placing their loans to better advantage later on. The immediate result was, of course, to shift the full force of the borrowing demands upon the members of the Clearinghouse Association, and their loans have consequently expanded in face of heavy lending by foreign bankers in the local market. There is, to be sure, an obvious limit to this sort of movement, for when reserves of the New York banks are nearing exhaustion and money rates work higher, the outside institutions will again appear as lenders, and the substitution of their capital for that of the local banks will allow the latter to retrench their loans and correspondingly reduce their liabilities. At the same time the offerings of foreign credit, which have been such a feature during the past week, will probably continue. But it is still a matter of great doubt how far these factors will provide an offset to the heavy demands for currency, now close at hand from the interior cities. At all events money rates are pretty certain to rule higher than the present before many weeks have elapsed.

The Stock Market

Fears of unfavorable developments in the money market continue to restrict genuine business on the Stock Exchange. Professional traders, working for small profits, and speculative cliques of greater or less calibre, have kept on from time to time with their endeavors to bid up various individual stocks, and they have had a fair measure of success. But if their purpose is to lighten loads which have become uncomfortably heavy or to distribute holdings on which paper profits have accrued, it is more than doubtful whether they have done much toward attaining the desired end. The operations now being witnessed in the market consist very largely of manipulation in which speculative interests are pitted against one another in an effort to secure the most advantage from temporary fluctuations. This manipulation is directed toward a higher rather than a lower price level, because general conditions are more conducive to buying than to selling among actual investors. There is no change in the main aspects of the outside situation from what have been noted for several weeks past. With the exception of the problems awaiting solution in the money market, everything is calculated to inspire confidence among holders of securities. Nothing now can happen to seriously hurt the grain crops; we are unquestionably on the eve of one of the greatest harvests the country has ever known. What this means for future railroad earnings, for general business, and for corporation dividends, is something which may be left to the imagination of the average observer. Yet even in the midst of this brilliant prospect the question must constantly arise, how far the very high range of prices has discounted this prospective prosperity. Evidently apart from the uncertainty of the money position, and any adverse effects upon the speculation that it may have later on, the present market is one where careful discrimination must be exercised between stocks which are relatively high, and therefore are in the danger zone, and stocks which are relatively low, and have reasonable probabilities of further advance.

The local traction group has not been at all conspicuous in the week's general dealings. Metropolitan and Brooklyn Rapid Transit have been left pretty much to themselves, and have followed the usual course of neglected securities in a highly speculative market. On the other hand Manhattan seems to have been quietly but persistently bought ever since the troubles with the company's employees were amicably settled.

Philadelphia

All the securities interested in one way or another with the recent Philadelphia trolley combination have reached new high-record prices during the week. Union Traction sold up to 48¼, and Philadelphia Rapid Transit to 14⅛, while Fairmount Park Transportation, which rumor has associated with the "deal," went up to 34. A movement similar to that in Park Transportation was inaugurated in the securities of another outlying Philadelphia company, the Huntingdon & Broad Top, the common stock rising sharply from 28 to 32, and the preferred gaining 2 points to 59. How far there is any genuine basis for the advance in the suburban line shares is still very doubtful. Nothing but denials have so far issued from official sources, and it is natural, therefore, that suspicion should have been aroused lest the rise was simply a shrewd piece of speculation conducted on rumors which sound plausible. The one thing certain is that the earnings of the Park Transportation line would not justify a purchasing syndicate in paying anything above present quotations for the stock. Other sales of the week comprise American Railways at an advance to 50—the highest on record—Railways General bid up from 4¾ to 5⅜; Philadelphia Traction at 99⅞, Consolidated Traction, of New Jersey, at 69½; United Traction, of Pittsburgh, preferred, at 52, and Rochester Railway, common, at 67. In bonds, Electric People's Traction 4s advanced to 99⅞, Union Traction, of Indiana, 5s sold at 102⅛; Consolidated, of New Jersey, 5s at 111, Indianapolis Railway 4s at 87½, United Traction, of Pittsburgh, 5s at 117, and United Railways 4s at 87.

Chicago

Chicago securities have merely kept steady during the week, displaying no particular feature, and not footing up much of a total in actual transactions. Union Traction held firm on light trading around 16¼, and 50 shares of City Railway sold at 216. West Chicago was steady at 95. Metropolitan Elevated, preferred, selling ex-dividend rose a point from 89 to 90. Lake Street was firmer at 10¾ with a few sales at 11, and one or two small lots of South Side sold at 110. Nothing was done in the Northwestern Elevated stocks. Officials of the road now say that no new developments in the way of extensions will occur before the end of September. Metropolitan earnings for August, it is said, will show increase of 20 per cent over last year, and Northwestern earnings a gain of 15 per cent. The Metropolitan expects to derive considerable benefit from the new Aurora-Wheaton electric line, which was opened for business last week.

Other Traction Securities

It has been another featureless week in the Boston market. Boston Elevated, on scattered sales, declined to 159, which is the lowest of the year. West End was weak, in sympathy, at 94, and Massachusetts Electric, on light trading, held its own at 40½. In Baltimore the United Railway issues were strong, especially the general mortgage 4s, which went up to 98¼—the highest of the season. The incomes were dealt in moderately at 70¾, and the stock at 16. Nashville Railway certificates were comparatively inactive but strong, at an advance from 74¼ to 76. The stock rose sympathetically from 5⅝ to 5⅞. Among the other sales of the week in Baltimore may be noted Knoxville Railway 5s at 101, United Traction, of Pittsburgh, 5s at 116⅛, Atlanta Railway 5s at 106¼, City Passenger 4½s at 104½, Norfolk Railway & Lighting 5s at 95 to 95½, and Charleston Consolidated Electric 5s at 94¼. No further change is recorded in North Jersey Traction, the common being quotably unchanged at 34½, and the bonds at 85. New Orleans securities have been active and strong in their local market, selling up to 18. Traction sales on the Cleveland Stock Exchange last week numbered 3107 shares, a gain of several hundred shares over the previous week. Cincinnati, Dayton & Toledo continues to hold the center of the stage, sales numbering 1060 shares, at prices ranging from 26⅝ to 27¼, last sale at the high figure. Northern Ohio Traction continues strong, the common at 45 for 515 shares and the preferred 620 shares at 90 and 91. Lake Shore Electric dropped from the week previous. The total sales were 430, at from 16 to 17½; last week the stock went as high as 19¼. Western Ohio sold for 250 shares at 24½ to 25¼. Only one sale was made in Detroit United, 100 shares at 86½, three-quarters below previous sales. Big Consolidated was strong, but there is little on the market. A small block was taken at 86¾. Monday Northern Ohio common took a remarkable jump, probably as the result of the report that the company is to be reorganized on a basis profitable to stockholders. The first sale was at 45, and it increased steadily to

51; sales were all in small lots, the total numbering only about 150 shares. The preferred was strong at 91, about 300 shares selling. A small block of Cleveland, Elyria & Western went at 70 which is considerably below last sales. Big Consolidated advanced to 87 for a small lot.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 12	Aug. 19
American Railways Company	50	49¾
Boston Elevated	161½	159½
Brooklyn R. T.	67⅞	67
Chicago City	210	210
Chicago Union Tr. (common)	15⅛	16
Chicago Union Tr. (preferred)	48	48
Cleveland Electric	86	88
Columbus (common)	54	57
Columbus (preferred)	107	108
Consolidated Traction of N. J.	71¼	69½
Consolidated Traction of N. J. 5s	111	111
Detroit United	85⅝	86
Electric People's Traction (Philadelphia) 4s	99¾	99¾
Elgin, Aurora & Southern	40	40¼
Indianapolis Street Railway 4s	..	87½
Lake Street Elevated	10⅜	10½
Manhattan Railway	134	135⅛
Massachusetts Elec. Cos. (common)	41	40
Massachusetts Elec. Cos. (preferred)	97¾	97½
Metropolitan Elevated, Chicago (common)	39½	38½
Metropolitan Elevated, Chicago	91½	*89½
Metropolitan Street	148½	147½
North American	123	122¼
Northern Ohio Traction (common)	41½	51
Northern Ohio Traction (preferred)	90	91½
North Jersey	35½	36
Northwestern Elevated, Chicago (common)	36½	..
Philadelphia Rapid Transit	14	14
Philadelphia Traction	99¾	99¾
St. Louis Transit Co. (common)	31⅜	31⅜
South Side Elevated (Chicago)	112	110
Southern Ohio Traction	77⅛	75
Syracuse Rapid Transit	30	27
Syracuse Rapid Transit (preferred)	74	70
Third Avenue	130	130
Toledo Railway & Light	32½	33⅜
Twin City, Minneapolis (common)	125	127¼
United Railways, St. Louis (preferred)	*85	84
United Railways, St. Louis, 4s	87¼	87
Union Traction (Philadelphia)	47⅛	48
Western Ohio Railway	25¼	24½
New Orleans Railways (common)	..	17¾
New Orleans Railways (preferred)	57½	56¾

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

According to the usual monthly figures compiled by the Iron Age, the average weekly output of blast furnaces was 336,465 tons on Aug. 1, as against 350,890 tons on July 1. This decrease is wholly due to the troubles in Pennsylvania and the South with the coal miners, which have necessitated the shut-down of a number of furnaces. Such curtailment of production is not necessary to insure the soundness of the present iron market, but coming accidentally it affords an additional safeguard to the situation. Imports are on the increase in the steel trade, and there is talk of some being made in the structural branch of the industry. Quotations are unchanged from last week at $21.75 for Bessemer pig, $33 for steel billets and $28 for steel rails.

Metal

Quotations for the leading metals are as follows: Copper, 17½ to 17¾ cents; lead, 4⅜ cents; tin, 28 cents; spelter, 4.45 cents.

WASHINGTON, D. C.—The Capital Traction Company recently sold to the Government a parcel of land, and part of the proceeds of the sale will be distributed among stockholders in the form of an extra dividend of 4 per cent, which will be payable Aug. 20 to stockholders of record Aug. 4. The remainder will be invested in the 4 per cent bonds of the company.

SPRINGFIELD, ILL.—The entire issue of $125,000 first mortgage bonds, made in 1890 by the Springfield Consolidated Railway, has been called, and will be paid on Sept. 1, at 105 and interest by the Mercantile Trust Company, of New York.

MICHIGAN CITY, IND.—Judge Baker, on application of the trustee for the bondholders, has appointed A. L. Boyd as receiver of the Lake Cities Electric Railway Company, to succeed I. I. Spiro.

BALTIMORE, MD.—A mortgage has been filed for $2,000,000 by the Baltimore, Washington & Annapolis Electric Railway Company in favor of the Federal Trust Company, of Cleveland, Ohio. The mortgage is to guarantee an issue of bonds for the completion of the company's road, which will connect Baltimore with the National Capital.

DETROIT, MICH.—It is said here that plans are being matured for consolidating the Detroit, Ypsilanti, Ann Arbor & Jackson Railway and the Grand Rapids, Grand Haven & Muskegon Railway. It is even said that several other lines will be brought under one management, and the consolidation of the lines with the Detroit United Railway is hinted at.

WORCESTER, MASS.—The Railroad Commissioners will give a hearing Sept. 8 on the petition of the Worcester & Connecticut Eastern Railway Company for the right to lease the Webster & Dudley Street Railway. The Webster & Dudley Company now operates the Worcester & Webster Street Railway, so that the lease asked for is to give control to the Worcester & Connecticut Eastern of the line between Worcester and Danielson, Conn.

BOSTON, MASS.—The West End Street Railway Company has applied to the Railroad Commisisoners for authority to issue $3,559,000 4 per cent thirty-year bonds, dated Aug. 1, 1902. The purpose of the company is to use $3,000,000 of the new bonds to refund a like amount of bonds due Nov. 1, 1902, and $559,000 for additional improvements made on the property of the Boston Elevated Railway Company.

BUFFALO, N. Y.—The International Railway Company has been granted the approval of the State Railroad Commission for an increase of its capital stock from $10,200,000 to $17,000,000.

BUFFALO, N. Y.—In accordance with an agreement reached by the creditors and bondholders of the Buffalo, Hamburg & Aurora Railway, Justice Kenefick, at Buffalo, has ordered that Robert W. Day shall be appointed receiver of the company; that the road shall be sold; that the $300,000 bonds shall be declared valid, and that the other creditors shall be paid 60 cents on the dollar from the proceeds of the sale before anything can be paid on the bonds. It is said that the receiver will be permitted to operate the road long enough to determine its earning capacity before it is offered for sale.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Railroad Company reports earnings as follows:

Year ending June 30	1902	1901
Gross earnings	$687,195	$615,162
Operating expenses	384,265	340,830
Earnings from operation	$302,930	$274,332
Other income	6,089	6,137
Total income	$309,019	$280,469
Fixed charges	228,246	223,918
Net earnings	$80,773	$56,551
Total surplus June 30	99,918	92,925
Betterments for year	118,796	61,591

STATEN ISLAND, N. Y.—The Staten Island Railway reports earnings as follows:

Quarter ending June 30	1902	1901
Gross receipts	$46,554	$40,983
Operating expenses	32,386	34,576
Earnings from operation	$14,189	$6,407
Other income	6,083	6,029
Total income	$20,252	$12,436
Charges	8,782	8,473
Surplus	$11,470	$3,963

CLEVELAND, OHIO.—The stockholders of the Securities Company, of Cleveland, which suspended operations at the time of the Everett-Moore embarrassment, met last week and decided to liquidate. F. S. Borton, president of the company, and Charles Wason were authorized to take charge of the details of the liquidation, which will take place Nov. 1. It is stated that all debts will be paid in full. The company was organized to finance Everett-Moore propositions.

CLEVELAND, OHIO.—The Everett-Moore syndicate has completed a general plan for financing the Lake Shore Electric Railway, and the details will be announced next week. The plan has been accepted by the Cleveland banks, which are to purchase a large block of bonds. As soon as the plan becomes operative, the road will be taken out of the hands of the receiver. The plan contemplates a general consolidated mortgage of $6,000,000. Under this there will be a $4,000,000 issue of first consolidated bonds, $750,000 of which will go to take the Lorain & Cleveland outstanding bonds, and $1,500,000 to retire the Toledo, Fremont & Norwalk bonds. The remaining $1,750,000 will be taken by Cleveland banks at 90 and accrued interest. This will yield $1,575,000 cash that will be used to retire $500,000 Sandusky & Interurban bonds, and about $350,000 receiver's certificates, leaving over $350,000 cash in the treasury. The first consolidated bonds will be a first lien on the 80 miles included in the Sandusky & Interurban and Sandusky, Norwalk & Southern, and a second lien on the Lorain & Cleveland and the Toledo, Fremont & Norwalk. Of the additional $2,000,000 bonds that will be used as general bonds, $1,000,000 will be exchanged bond for bond for the present outstanding Lake Shore Electric bonds, nearly all of which are held by the Everett-Moore syndicate; the remaining $1,000,000 will be held in the treasury for future needs. The company is now operating through service from Cleveland to Toledo and the property will be improved as rapidly as possible.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has called for redemption, at 105 and interest, twenty-two Philadelphia Traction 4 per cent collateral trust bonds of 1917.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., July '02	81,130	40,588	40,542	------	------
	1 " " '01	66,898	33,484	33,414	------	------
	6 " June '02	318,937	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,725	*317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., July '02	140,209	89,013	51,197	23,866	27,331
	1 " " '01	134,370	79,638	54,732	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,075	------	------
	1 " " '01	15,678	9,341	6,337	------	------
	10 " " '02	187,658	103,986	83,672	------	------
	10 " " '01	169,756	94,355	75,401	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., June '02	1,165,288	*732,152	433,136	------	------
	1 " " '01	1,181,023	*732,740	448,283	------	------
	12 " " '02	12,789,705	*8952214	3,837,490	------	------
	12 " " '01	12,101,198	*7970635	4,130,563	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., June '02	271,245	147,614	123,632	97,043	26,589
	1 " " '01	409,206	192,265	216,941	94,098	122,842
	1 " " '00	218,738	106,174	112,565	65,348	47,217
	3 " " '02	786,280	436,915	349,366	289,063	60,303
	3 " " '01	952,792	485,899	466,894	272,864	194,030
	3 " " '00	681,371	333,927	297,444	221,844	75,601
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., July '02	48,569	30,509	18,059	13,617	4,442
	1 " " '01	46,067	27,021	19,046	13,639	5,407
	5 " " '02	313,767	172,009	141,758	67,707	74,051
	5 " " '01	200,964	134,849	66,115	68,922	† 2,807
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., July '02	23,591	7,586	16,005	------	------
	1 " " '01	23,459	7,689	15,770	------	------
	7 " " '02	102,531	45,638	56,892	------	------
	7 " " '01	88,920	42,091	46,829	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
Union Traction Co.	12 m., June '02	7,942,468	4,570,719	3,371,749	3,619,277	† 247,528
	12 " " '01	8,158,809	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	------	------
	1 " " '01	2,435	3,016	† 581	------	------
	12 " Dec. '01	47,976	*32,002	15,974	13,023	2,951
	12 " " '00	49,646	*33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	------	------
	1 " " '01	3,525	4,037	† 512	------	------
	12 " Dec. '01	90,390	52,022	38,368	43,678	† 4,310
	12 " " '00	62,893	36,672	26,221	36,148	† 9,927
Cleveland El. Ry. Co.	1 m., May '02	217,563	------	------	------	------
	1 " " '01	187,049	------	------	------	------
	5 " " '02	962,890	------	------	------	------
	5 " " '01	854,594	------	------	------	------
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., July '02	28,542	13,875	14,667	------	------
	1 " " '01	24,228	11,810	12,419	------	------
	7 " " '02	156,934	91,603	65,331	------	------
	7 " " '01	131,255	76,069	55,187	------	------
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	------	------
	1 " " '01	15,748	8,035	7,714	------	------
	6 " " '02	79,557	44,670	34,857	------	------
	6 " " '01	65,449	36,228	29,221	------	------
	12 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*89,592	71,520	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,545	* 42,671	34,875	15,614	19,261
	1 " " '01	72,201	* 42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,025	81,248
	6 " " '01	384,638	*235,852	148,786	94,105	54,681
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,533	57,983	32,865	26,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,293	818,521	688,965	383,180	305,785
	12 " " '00	1,302,296	722,458	579,839	374,291	205,548
DETROIT, MICH.						
Detroit United Ry.	1 m., July '02	325,898	182,848	143,050	------	------
	1 " " '01	302,988	149,812	153,176	------	------
	6 " June '02	1,600,675	* 907,044	693,631	395,739	297,892
	6 " " '01	1,384,181	* 775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,692	1,124
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., July '02	52,632	24,985	27,647	9,685	17,963
	1 " " '01	45,983	22,117	23,866	9,218	14,647
	7 " " '02	298,038	157,398	140,640	67,529	73,111
	7 " " '01	254,322	141,720	112,602	63,984	48,618
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., July '02	40,472	21,197	19,275	8,333	10,941
	1 " " '01	36,454	16,218	20,236	8,333	11,903
	7 " " '02	226,929	136,723	90,206	58,333	31,873
	7 " " '01	204,102	119,142	84,960	58,333	26,627
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., June '02	20,714	9,909	10,805	------	------
	1 " " '01	16,257	8,999	7,388	------	------
	6 " " '02	111,972	60,838	51,134	------	------
	6 " " '01	80,340	51,464	28,876	------	------
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., July '02	16,337	9,297	7,040	2,311	4,730
	1 " " '01	15,303	8,767	6,537	2,144	4,393
	7 " " '02	81,401	52,464	28,937	15,904	13,033
	7 " " '01	75,416	48,718	26,698	14,076	12,622
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m. July '02	237,376	110,928	126,448	67,989	58,459
	1 " " '01	239,043	102,095	136,948	67,992	68,956
	7 " " '02	1,512,005	723,232	788,773	457,543	331,230
	7 " " '01	1,362,807	688,559	674,249	433,315	240,934
	12 " Dec., '01	2,442,342	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., July '02	337,452	142,369	195,083	58,733	136,349
	1 " " '01	290,648	135,349	155,298	57,820	97,478
	7 " " '02	2,003,892	922,740	1,081,152	410,266	670,885
	7 " " '01	1,748,182	823,680	924,501	387,548	536,953
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., June '02	187,662	80,655	107,007	19,391	87,615
	1 " " '01	180,926	97,782	83,144	14,272	68,871
	9 " " '02	1,445,180	846,893	598,287	144,299	453,989
	9 " " '01	1,355,026	841,469	573,557	90,268	423,288
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,135	880,329
	3 " " '00	2,728,598	1,340,696	1,387,902	749,857	638,045
	12 " Sept. 01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '02	15,866,641	7,385,883	8,480,758	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PHILADELPHIA, PA.						
American Railways	1 m., July '02	119,870	------	------	------	------
	1 " " '01	89,658	------	------	------	------
	12 " June '02	1,009,509	------	------	------	------
	12 " " '01	844,298	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,426	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	527,742	288,005	239,737	148,608	91,130
	6 " " '01	495,226	306,966	188,259	147,157	41,102
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., June '02	60,863	34,780	26,064	19,025	7,039
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	693,284	384,265	309,019	228,246	80,773
	12 " " '01	621,299	340,830	280,469	223,918	56,550
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., June '02	122,682	65,143	57,539	37,854	19,685
	1 " " '01	112,900	53,923	58,978	24,271	34,707
	6 " " '02	671,284	352,382	318,902	227,033	91,869
	6 " " '01	598,928	303,402	295,526	145,625	149,901
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,936	35,600	22,336	25,000	† 2,663